

ADDENDUM-02

SUMMARY OF ADDENDUM-2 PERTAINING TO AMENDMENTS IN RFP FOR DESIGN, MANUFACTURE, SUPPLY, INSTALLATION, TESTING & COMMISSIONING OF CLOSED CIRCUIT TELEVISION SYSTEM (CCTV) FOR 3 PRIORITY CORRIDORS OF PHASE-IV PROJECT OF DELHI MRTS.								
S.No.	Part No.	Section No.	Bid Document/Chapter	Page No.	Page No. to be replaced with (attached below)	Clause No.	Original Bid Condition	DMRC's Response
1	PART-1	Section-I	ITB	Cover Page	Revised Cover Page	NA	DESIGN, MANUFACTURE, SUPPLY, INSTALLATION, TESTING & COMMISSIONING OF RADIO SYSTEM FOR 3 PRIORITY CORRIDORS OF PHASE-IV PROJECT OF DELHI MRTS	The Title may be amended as: Referred typo error on Cover page of Bidding Procedure shall be corrected by striking out 'Radio System' with ' Closed Circuit Television (CCTV) system '
2	PART-2	Section-VI	CHAPTER-1	16	16R	1.6.10 (4)	The CCTV Contractor shall provide a rack for housing the telecom equipment's in the RSS. The UPS supply for the telecom equipment's shall be provided by Traction Contractor	Clause may be amended as: The CCTV Contractor shall provide a 42 U rack for housing the telecom equipment's in the RSS. The UPS supply for the telecom equipment's shall be provided by Traction Contractor Note: For rack shall be supplied as per specifications mentioned in Appendix-Q, Chapter-4 (Appendices).. For cable laying to RSS please refer to Appendix , Chapter-3 (Interfaces - Roles & Responsibilities)
3	PART-2	Section-VI	CHAPTER-1	27	27R	New	NA	Following new clause (5.2.2 (7)) is added: Clause 5.2.2, Chapter-1 (General Requirements) Clause 5.2.2 (7) - Remote Access of the System shall normally not be provided on security considerations.
4	PART-2	Section-VI	CHAPTER-1	65	65R	10.11.13	The cabinet racks supplied shall be of "Rittal – TS8" or equivalent or better make & model duly painted and finished to International standards and suitable for indoor use. The contractor shall submit details of cabinets proposed to be supplied for approval of Employer.	Clause may be amended as: The cabinet racks supplied shall be Rittal, Panduit, Conteg, APW President or equivalent make duly painted and finished to International standards and suitable for indoor use. The contractor shall submit details of cabinets proposed to be supplied for approval of Employer. Note: The clause may be read in conjunction with Appendix-Q , Chapter-4 (Appendices) and Clause 5.3.1 , Chapter-2 (Technical Requirements).
5	PART-2	Section-VI	CHAPTER-2	1 to 66	1R to 67R	Complete Document	Chapter-2 Technical Requirements	Complete Document has been replaced. All ammndments have been summarised in Sheet attached with revised Chapter-2 (Technical Requirements) Ver.1
6	PART-2	Section-VI	CHAPTER-4	61	61R	Appendix-N (MMI) (S.No. 5)	1) SPECIFICATIONS FOR Work Station (MMI) (5) Storage :- 1) 2 nos. x 2TB M/2 PCIe NVMe Solid State Drives in RAID-1 2) 2TB SSD / SATA 7200 rpm Hard Drive	Clause may be amended as: 1) SPECIFICATIONS FOR Work Station (MMI) (5) Storage :- 1) 1 no. x 2TB M/2 PCIe NVMe Solid State Drives 2) 2TB SSD / SATA 7200 rpm Hard Drive

SUMMARY OF ADDENDUM-1 PERTAINING TO AMENDMENTS IN RFP FOR DESIGN, MANUFACTURE, SUPPLY, INSTALLATION, TESTING & COMMISSIONING OF CLOSED CIRCUIT TELEVISION SYSTEM (CCTV) FOR 3 PRIORITY CORRIDORS OF PHASE-IV PROJECT OF DELHI MRTS.								
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7	PART-2	Section-VI	CHAPTER-4	61	61R	Appendix-N (MMI) (S.No. 6)	<p>1) SPECIFICATIONS FOR WORKSTATION (MMI)</p> <p>(6) Display</p> <p>1) Common features:</p> <p>a) Viewing angle (H/V): 170 degree or better</p> <p>b) Connectivity:</p> <p>i) 1 x Display Port / DVI (in)</p> <p>ii) 1 x Display Port / HDMI (out)</p> <p>iii) 1 x HDMI (in)</p> <p>iv) 1 x Analog 2.0 audio line out (3.5mm jack).</p> <p>v) 1 x VGA (in) (Optional)</p> <p>c) Integrated Soundbar (Min. 3.5Watts)</p> <p>d) Response Time: 5 ms or better</p> <p>e) Image Brightness (typical): 350 cd/m2 or better</p> <p>f) Display Position Adjustments: Tilt, Swivel, Pivot, Height Adjustments etc.</p> <p>g) VESA Flat Panel Mount Interface.</p> <p>h) Operating Temperature: 0°C to + 50°C</p> <p>i) Humidity: Up to 80% RH (non-condensing)</p> <p>2) For CCTV System (DS-16)</p> <p>a) Viewable Size: 24" and 32" as per requirement (when measured diagonally)</p> <p>b) Resolution: 4K UHD (3840 x 2160) or better</p> <p>c) Image Contrast Ratio: (Typical) 3000:1 or better</p> <p>d) Colour Support: 1.07 billion or better</p> <p>3) For Other systems:</p> <p>a) Viewable Size: 24" or better when measured diagonally.</p> <p>b) Resolution: Full HD (1920 x 1200/1080) or better</p> <p>c) Panel Type: IPS or better</p> <p>d) Colour Support: 16.7 Million Colours or better</p>	<p>Clause may be amended as:</p> <p>6) Display - 1) Common features:</p> <p>a) Viewing angle (H/V): 170 degree or better</p> <p>b) Connectivity:</p> <p>i) 1 x Display Port / DVI (in)</p> <p>ii) 1 x Display Port / HDMI (out)</p> <p>iii) 1 x HDMI 2.0 Port (in)</p> <p>iv) 1 x Analog 2.0 audio line out (3.5mm jack).</p> <p>c) Integrated Soundbar (Min. 3.5Watts)</p> <p>d) Response Time: 5 ms or better</p> <p>e) Image Brightness (typical): 350 cd/m2 or better</p> <p>f) Display Position Adjustments: Tilt, Swivel, Pivot, Height Adjustments etc.</p> <p>g) VESA Flat Panel Mount Interface.</p> <p>h) Operating Temperature: 0°C to + 50°C</p> <p>i) Humidity: Up to 80% RH (non-condensing)</p> <p>2) For CCTV System (DS-16)</p> <p>a) Viewable Size: 24" and 32" as per requirement (when measured diagonally)</p> <p>b) Resolution: 4K UHD (3840 x 2160) or better</p> <p>c) Image Contrast Ratio: (Typical) 3000:1 or better</p> <p>d) Colour Support: 1.07 billion or better</p> <p>3) For Other systems:</p> <p>a) Viewable Size: 24" or better when measured diagonal</p> <p>b) Resolution: Full HD (1920 x 1200/1080) or better</p> <p>c) Panel Type: IPS or better</p> <p>d) Colour Support: 16.7 Million Colours or better</p>
8	PART-2	Section-VI	CHAPTER-4	62	62R	Appendix-N (MMI) (S.No. 8)	<p>1) SPECIFICATIONS FOR WORKSTATION (MMI)</p> <p>(8) Additional Ports</p> <p>USB 3.x Gen. Ports - 4 nos.</p> <p>HDMI Port - 1 no.</p> <p>VGA Port – 1 no. (with Adapter, if required)</p>	<p>Clause may be amended as:</p> <p>1) SPECIFICATIONS FOR WORKSTATION (MMI)</p> <p>8) Additional Ports - USB 3.x Gen. Ports - 4 nos.</p> <p>HDMI Port on Chipset - 1 no.</p>
9	PART-2	Section-VI	CHAPTER-4	63	63R	Appendix-N (LCT) (S.No. 3)	<p>3) SPECIFICATIONS FOR LAP TOP (LOCAL CRAFT TERMINAL)</p> <p>(3) Storage - 512GB M.2 PCIe NVMe Solid State Drive + 1TB 7200 rpm 2.5" SATA Hard Drive</p>	<p>Clause may be amended as:</p> <p>3) SPECIFICATIONS FOR LAP TOP (LOCAL CRAFT TERMINAL)</p> <p>3. Storage - 1TB M.2 PCIe NVMe Solid State Drive</p>
10	PART-2	Section-VI	CHAPTER-4	63	63R	Appendix-N (LCT) (S.No. 5)	<p>3) SPECIFICATIONS FOR LAP TOP (LOCAL CRAFT TERMINAL)</p> <p>(5) Port -</p> <p>RJ45 Ports - 10/100/1000Mbps GbE - 1 no.</p> <p>USB 3.x Gen. Ports - 3 nos.</p> <p>HDMI Port - 1 no.</p> <p>VGA ports - 1 no. or with USB convertor</p>	<p>Clause may be amended as :</p> <p>3) SPECIFICATIONS FOR LAP TOP (LOCAL CRAFT TERMINAL)</p> <p>5) Port -</p> <p>RJ45 Ports - 10/100/1000Mbps GbE - 1 no.</p> <p>USB 3.x Gen. Ports - 3 nos.</p> <p>HDMI Port - 1 no.</p>

SUMMARY OF ADDENDUM-1 PERTAINING TO AMENDMENTS IN RFP FOR DESIGN, MANUFACTURE, SUPPLY, INSTALLATION, TESTING & COMMISSIONING OF CLOSED CIRCUIT TELEVISION SYSTEM (CCTV) FOR 3 PRIORITY CORRIDORS OF PHASE-IV PROJECT OF DELHI MRTS.								
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11	PART-2	Section-VI	CHAPTER-4	73	73R	Appendix-Q (Clause 1.1 (ix))	1. SPECIFICATION OF RACK 1.1 FLOOR MOUNTED RACK - 42U, 19" (800W X 2000H X 1000D): (ix) Make- Rittal, APW President or equivalent subject to meeting the above specifications	Clause may be amended as: 1.1 (ix) Make - Rittal, Panduit, Conteg, APW President or equivalent subject to meeting the above specifications
12	PART-2	Section-VI	CHAPTER-4	73	73R	Appendix-Q (Clause 1.2 (v) (a))	1. SPECIFICATION OF RACK 1.2 WALL MOUNT RACK- 19" (9U, 6U & 3U) v) Rack shall have following as a minimum: a) Top and bottom cover.	Clause may be amended as : 1.2 (v) (a) Top, Bottom & Rear cover. Note : The requirement of PU Gasket for Top & Bottom Cover may be decided by the Bidder(s) based on individual design. Details may be included in the detailed design and submitted for review & approval of the Engineer.
13	PART-2	Section-VI	CHAPTER-4	74	74R	Appendix-Q (Clause 1.2 (v) (h))	1. SPECIFICATION OF RACK 1.2 WALL MOUNT RACK- 19" (9U, 6U & 3U) v) (h) Rack shall be of Make Rittal, APW President, RPG Raychem, 3M etc. or equivalent subject to meeting the above specifications.	Clause may be amended as: 1.2 (v) (h) Make - Rittal, Panduit, Conteg, APW President or equivalent subject to meeting the above specifications
14	PART-2	Section-VI	CHAPTER-4	75	75R	Appendix-Q (Clause 5)	5) All Racks, FMS, ODF & DDF etc. shall confirm to UL2416 and UL60950-1 or equivalent standard. The contractor shall submit details of equivalent standard and its compliance to the Engineer for review and approval"	Clause may be amended as: 5) All Racks, FMS, ODF & DDF etc. shall confirm to UL2416 and UL60950-1 or equivalent standard. OEM should be ISO 9001, ISO 14001, ISO 45001 certified. The contractor shall submit details of equivalent standard and its compliance to the Engineer for review and approval"
15			BOQ	NA	NA	New		Following new Items have been added : - 2 (g) (i) IP based Bulltlet Camera (Quad HD or better) with all associated accessories including integrated Varifocal lens, housing, mounting arrangement, SPD etc, as per specifications mentioned in the PS. 2 (g) (ii) License for item g(i) above.
16			BOQ	NA	NA	Item 2 (g)	Item Description: NVR server with RAID-5 configuration as per PS Quantity : 97	Item No. and Quantity of NVRs may be amended as: BOQ Item No. : 2 (h) Item Description : NVR server with RAID-5 configuration as per PS Quantity : 52
17	PART-2	Section-VI	Tender Drawings	Volume-1 to Volume-7	Volume-1 to Volume-15	New	Tender Drawings (Volume-1 to Volume-7)	Following drawings are being included in Part-2 , Section VI , Tender Drawings: 1) Track Plan & GAD 2) River Bridges 3) Depot It is brought out that drawings for Underground stations & FOBs have already been provided with the Tender Documents.

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S.No.	Part No.	Section No.	Bid Document/ Chapter	Page No.	Page No. to be replaced with (attached below)	Clause No.	Original Bid Condition	DMRC's Response
18	PART-3	Section-VIII	Particular Conditions (PC)	21	21R	13.8	Adjustments for Changes in Cost p = Cost Coefficient of Labour to the Total Cost = 0.30 = Cost Coefficient of Fuel and Power to the Total Cost = 0.15	Clause may be amended as: Adjustments for Changes in Cost p = Cost Coefficient of Labour to the Total Cost = 0.30 q = Cost Coefficient of Fuel and Power to the Total Cost = 0.15

Note : The Tender Validity shall be read and considered as "120 days" instead of "180 days" as inadvertently mentioned in Tender summary details on CPP Portal (<https://eprocure.gov.in/>).



DELHI METRO RAIL CORPORATION LIMITED

BIDDING DOCUMENTS

FOR

CONTRACT DS-16

DESIGN, MANUFACTURE, SUPPLY, INSTALLATION, TESTING & COMMISSIONING OF CLOSED CIRCUIT TELEVISION (CCTV) SYSTEM FOR 3 PRIORITY CORRIDORS OF PHASE-IV PROJECT OF DELHI MRTS

PART 1: BIDDING PROCEDURES

SECTION I - INSTRUCTIONS TO BIDDERS (ITB)

DELHI METRO RAIL CORPORATION LTD.

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Barakhamba Road, New Delhi –110 001



- 2) The security inspection area at station entrances and external approaches to the entrance shall be covered by CCTV cameras with associated monitors in the Station Security Office.
- 3) Important locations / rooms in back of house at stations will also be covered by CCTV surveillance.

1.6.6 **Central Equipment Room in OCC**

The Central Equipment Room (CER) shall be situated near the Operations Control Centre for accommodating central communications equipment.

1.6.7 **Backup Control Centre (BCC)**

Telecommunication equipments in Central Equipment Room (CER) of Backup Control Centre shall be installed for accommodating backup of central communications equipment at OCC.

1.6.8 **Headquarters**

- 1) The Headquarter will be used for all administrative functions associated with the operation and maintenance of the DMRTS. The headquarters will be located at Metro Bhawan.
- 2) The Contractor shall coordinate requirements for incoming cable routing with the Designated Contractor responsible for works of Central system/Theatre at the Headquarter and shall be responsible for installation of equipment and external connections to this building required for functionalities pertaining to OCC.

1.6.9 **Depot Security Office (DSO)**

The Depot Security Office shall be located at the main entrance of depots. The DSO shall have all necessary communications facilities. It shall be designed to provide automated security systems including CCTV coverage to depot areas, entrances and perimeter fencing. The DSO will be provided with a PABX Telephone & CCTV MMI.

1.6.10 **Receiving Substation (RSS)**

- 1) For the RSS, the communication Contractors shall provide, as a minimum, the following communications facilities:
 - i) PABX telephone communications to all station & depot areas of the DMRTS;
 - ii) Radio communications with users on the DMRTS;
 - iii) CCTV cameras & MMI for providing coverage of the RSS.
 - iv) Digital Indoor Clock at suitable location.
- 2) The FOTS (Fibre Optics Transmission System) for all RSSs will be extended from the nearest station with help of OFC.
- 3) The trenching required for extension of fiber/copper connectivity to the RSS shall be provided by the Traction Contractor.

Cable laying/blowing shall be done in line of Traction contractor and termination shall be provided by the communication Contractor.
- 4) The CCTV Contractor shall provide a **42 U** rack for housing the telecom equipment's in the RSS. The UPS supply for the telecom equipment's shall be provided by Traction Contractor.



5. FUNCTIONAL REQUIREMENTS

5.1 GENERAL

The Contractor shall design the System such that operation of the System shall be in line with the provisions in the GS under normal and emergency conditions.

5.2 OPERATION

5.2.1 General

- 1) This part of the document only covers the general operational requirements of the System.
- 2) The operational requirements and modes of individual Sub-systems shall be as given in Chapter-2, Chapter-3 and Chapter-4 of this PS.

5.2.2 IT security Policy

- 1) Every networking equipment associated with the Telecom system shall be password-protected.
- 2) Unused access port of every networking equipment shall be disabled to prevent any unauthorized access.
- 3) Used access port of every networking device shall be MAC-bounded.
- 4) Data Transmission ports such as USB, RS-232 port etc. shall be disabled if not in use.
- 5) Any default sharing of files and folder shall be removed from servers/workstations.
- 6) Hard-coded password shall not be used in any privilege level.
- 7) **Remote Access of the System shall normally not be provided on security considerations.**

7) 8) The contractor shall submit an IT Security Policy document for the Telecom system for approval of the Engineer.

5.2.3 Man-Machine Interfaces (MMI)

The Contractor shall provide user-friendly Man-Machine Interfaces for DMRC staff to operate, control, monitor and maintain the Systems.

5.2.4 Network Management System (NMS)

All Subsystems shall be equipped with Network Management System individually, to provide the status monitoring, alarm management, configuration, analysis and overall control of respective sub-systems to the maintenance staff.



10.11 HOUSING, ENCLOSURE CABINET/RACK AND MOUNTING SUPPORT

- 10.11.1 All indoor equipment cabinets and equipment enclosures used for housing the equipment shall be provided with lock and key. Padlocks shall not be used.
- 10.11.2 The Contractor shall provide to the Employer, as a minimum, 3 keys per cabinet or equipment enclosure.
- 10.11.3 Sufficient ventilation shall be provided for the indoor equipment cabinets and enclosures in which active equipment are housed.
- 10.11.4 All outdoor equipment cabinets and equipment enclosures used for housing the Communication equipment shall be provided with suitable locking or protection arrangement.
- 10.11.5 The key or opening arrangement for identical equipment shall be same. The key or opening arrangement for different equipment should be same as far as possible.
- 10.11.6 Universal locks with a common key for all Indoor Cabinets, Outdoor Equipment enclosures & Line side location/ equipment boxes shall be provided. Systems should have maximum of three types of keys.
- 10.11.7 All cabinets to be used in equipment rooms except at OCC and BCC should conform to IP 54 with Glass doors. All outdoor equipment / Location boxes shall conform to IP 65. Uniformity in design of racks/cabinets shall be maintained.
- 10.11.8 The Contractor should supply equipment cabinets with required level of EMI & EMC immunity to ensure that the equipment housed in sub-racks would comply with the required EMI & EMC parameters.
- 10.11.9 All equipment installed shall be able to withstand vibration levels likely to be experienced in railway stations, tunnels and structures.
- 10.11.10 The communication sub-system contractors shall submit calculations to ensure the proposed brackets and mounting methods are of sufficient strength to withstand the wind load and weight of the equipment.
- 10.11.11 All visible mounting arrangements will be ergonomically designed, preferably with stainless steel or better material. The final mounting arrangement will be got approved from the Employer.
- 10.11.12 The Contractor shall submit installation method statements and related submission for each type of installation design and activities, at least 60 days before commencement of the activity, for review by the Employer.
- 10.11.13 The cabinet racks supplied shall be Rittal –TS8”, **Panduit, Conteg, APW President** or equivalent or better make & model duly painted and finished to International standards and suitable for indoor use. The contractor shall submit details of cabinets proposed to be supplied for approval of Employer.
- 10.11.14 The free standing type racks shall have split doors at the rear and transparent single doors at the front. Wall mount type shall be” hinged three part type” with transparent door opening at the front.
- 10.11.15 Each rack shall house power distribution and local circuit breakers for each unit of equipment requiring power contained there-in.
- 10.11.16 All free standing racks should be fitted with bottom plinths for floor fixing to masonry or to steel frames beneath the false floor. All free standing cabinets shall have eyebolts fitted on top of the cabinet for lifting purpose. All system cabinets and racks to be fully



DELHI METRO RAIL CORPORATION LIMITED

BIDDING DOCUMENTS

FOR

CONTRACT DS-16

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PART 2: EMPLOYER'S REQUIREMENTS

SECTION VI – PARTICULAR SPECIFICATIONS

**CHAPTER 2 – TECHNICAL REQUIREMENTS
(Ver.1)**

DELHI METRO RAIL CORPORATION LTD.

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**DESIGN, MANUFACTURE, SUPPLY,
INSTALLATION,
TESTING AND COMMISSIONING
OF
CLOSED CIRCUIT TELEVISION SYSTEM**

PARTICULAR SPECIFICATIONS

DS16

**CHAPTER 2
TECHNICAL REQUIREMENTS**

(Ver. 1)

DS-16: Summary of Amendments in Chapter-2 -Technical Requirements (Ver. 1)

S.No.	Bid Document/ Chapter	Page Nos. (Original)	Revised Page Nos. (Ver.1)	Clause No.	Original Bid Conditions	Amended Bid Conditions
1	Chapter-2	1	1R	NA	Table of Contents	Revised
2	Chapter-2	5	5R	1.2.14 (8)	End-to-end signal latency from any two points (source and destination) on the transmission network shall be suitable for establishing effective hand to eye coordination for remote operation of camera PTZ functions and shall be not exceed 150 m secs under conditions of maximum network traffic.	End-to-end signal latency from any two points (source and destination) on the transmission network shall be suitable for establishing effective hand to eye coordination for remote operation of camera PTZ functions and shall not exceed 200 m secs under conditions of maximum network traffic.
3	Chapter-2	5	5R	1.2.14 (9) Para 1	Both, live view and recording of all cameras shall be available / done locally and/or remotely at their maximum resolution with H.265 or better video compression (if available) with 25 and 30 fps as a minimum.	Both, live view and recording of all cameras shall be available / done locally and/or remotely at their maximum resolution with H.264 / H.265 or better video compression (if available) with 25 and/or 30 fps as a minimum. However, the video compression provided shall comply to provisions mentioned in S.No. (3) in Annexures 5 (a) & 5 (b).
4	Chapter-2	7	7R	2.2 (2)	Following IP based cameras with all accessories including vari-focal lens, IR Illuminator, Housing and mount etc.: i) Fixed Box Camera (Quad HD or better resolution) ii) Fixed Box Camera (4K UHD resolution). iii) Fixed Dome IR Camera (Quad HD or better resolution). iv) PTZ Dome IR Camera with all accessories (Quad HD or better resolution). v) Corner Lift Camera with all accessories (to be within scope of Lift contractor).	Following IP based cameras with all accessories including vari-focal lens, IR Illuminator, Housing and mount etc.: i) Fixed Box Camera (Quad HD or better resolution) ii) Fixed Box Camera (4K UHD resolution). iii) Fixed Dome IR Camera (Quad HD or better resolution). iv) PTZ Dome IR Camera with all accessories (Quad HD or better resolution). iv) Corner Lift Camera with all accessories (to be within scope of Lift contractor) except the quantities specifically included in the BoQ. v) Bullet Camera with all accessories (Quad HD or better resolution)
5	Chapter-2	12	12R	4.1 (4)	The CCTV System shall have high resolution IP based (Fixed Box (Quad HD & 4K UHD), Fixed Dome PTZ Dome & Corner Lift) colour cameras with all required accessories. CCTV contractor shall design location of all cameras so as to comply with the coverage requirements. The CCTV Coverage is to be provided by provision of Fixed Box, Fixed Dome and Corner lift cameras only. Coverage by PTZ cameras shall not be considered for provision of CCTV	The CCTV System shall have high resolution IP based (Fixed Box (Quad HD & 4K UHD), Fixed Dome, PTZ Dome, Bullet Camera (Quad HD) & Corner Lift) colour cameras with all required accessories. CCTV contractor shall design location of all cameras so as to comply with the coverage requirements. The CCTV Coverage is to be provided by provision of Fixed Box, Fixed Dome, Bullet Cameras and Corner lift cameras only. Coverage by PTZ cameras shall not be considered for provision of CCTV

S.No.	Bid Document/ Chapter	Page Nos. (Original)	Revised Page Nos. (Ver.1)	Clause No.	Original Bid Conditions	Amended Bid Conditions
					CCTV camera coverage plots for all the locations shall be submitted as part of the detailed design to the Employer's Representative for review and approval.	coverage. CCTV camera coverage plots for all the locations shall be submitted as part of the detailed design to the Employer's Representative for review and approval.
6	Chapter-2	12	12R	4.1 (7)	System shall use video signals from various types of indoor/outdoor IP cameras installed at different locations, process them for viewing on CCTV workstations simultaneously at Central Control Rooms (OCCs, BCC & IT Park) and local control rooms at every station, Depot & RSS.	System shall use video signals and audio signals from various types of indoor/outdoor IP cameras installed at different locations, process them for viewing on CCTV workstations simultaneously at Central Control Rooms (OCCs, BCC & IT Park) and local control rooms at every station, Depot & RSS. Use of the Audio Signal shall be configurable, as per requirement.
7	Chapter-2	12-13	12R-13R	4.1 (10)	Video signals from various cameras provided in Depot / Station / OCC / BCC / RSS & other locations shall be made available to the following: i) Respective NVRs (Primary and /or Secondary) ii) All Associated workstations/ MMIs iii) All Video walls provided in the network. iv) Video signals from all cameras provided at all locations in the network shall be seamlessly available for control & monitoring from / at all Workstation/MMIs and Video walls provided in the network. v) Any other location to be decided by the Employer's representative during detailed design review.	Video signals and audio signals from various cameras provided in Depot / Station / OCC / BCC / RSS & other locations shall be made available to the following: i) Respective NVRs (Primary and /or Secondary) ii) All Associated workstations/ MMIs iii) All Video walls provided in the network. iv) Video signals and audio signals from all cameras provided at all locations in the network shall be seamlessly available for control & monitoring from / at all Workstation/MMIs and Video walls provided in the network. Use of the Audio Signal shall be configurable, as per requirement. v) Any other location to be decided by the Employer's representative during detailed design review.
8	Chapter-2	16	16R	4.2 (3)	Table 2.6: Quantity & Type of Cameras at Various Locations Table 2.7: Quantity & Type of Cameras at Additional Locations	Quantities of Bullet cameras planned for various locations are included in Table 2.6 and Table 2.7 of Chapter-2 (Technical Requirement)
9	Chapter-2	16	16R	4.2 (3) Note	Note: - * Lift Camera shall be provided by Lift Contractor as per specs. communicated by Telecomm. Interface between Lift & CCTV contractors is detailed in Appendix-A2, Chapter-3 (Interfaces).	Note: - * Lift Camera shall be provided by Lift Contractor as per specs. communicated by Telecomm. Interface between Lift & CCTV contractors is detailed in Appendix-A2, Chapter-3 (Interfaces). (except the quantities specifically included in BoQ)
10	Chapter-2	17	17R	4.3 (1)	Network Video recording system shall comprise of COTS server at every station / location for Primary & Mirrored recording of all cameras of Local/Primary & Secondary stations/locations respectively.	Network Video recording system shall comprise of one COTS server at every station / location for Primary & Mirrored recording of all cameras of Local/Primary & Secondary stations/locations respectively.

S.No.	Bid Document/ Chapter	Page Nos. (Original)	Revised Page Nos. (Ver.1)	Clause No.	Original Bid Conditions	Amended Bid Conditions
11	Chapter-2	17	17R	4.3 (2)	<p>Viewing and recording of all types of cameras i.e. Full HD, Quad HD & 4K UHD at the Primary location shall be at Full resolution i.e. Full HD, Quad HD & 4 K UHD respectively at 25 FPS.</p> <p>The mirrored recording for the secondary location shall also be at Full resolution of the respective camera(s) i.e. Full HD, Quad HD & 4 K UHD respectively at 25 FPS.</p>	<p>Viewing and recording (Primary & Mirror) of all types of cameras i.e. Full HD, Quad HD & 4K UHD at any location shall be in accordance with resolution of the 1st & 2nd stream as specified in Annexure(s) 5 (a) & 5 (b) with frame rate at 25 / 30 fps.</p> <p>Recording System shall have the capability to record audio signals (configured as per requirement), received from local cameras at station / Depot / RSS / OCC / BCC along with the video recording (in same time-line) so that during playback of any camera from the workstation, video recording shall be played along with real time audio recording.</p>
12	Chapter-2	18	18R	4.3 (3)	<p>The Full resolution i.e. Full HD, Quad HD & 4 K UHD respectively at 25 FPS for each type of camera both for the Primary & Secondary location(s) shall determine the capacity of the storage device at every location.</p> <p>The storage capacity shall be calculated keeping in view the spare capacity of 25% of the installed capacity.</p>	<p>The Full resolution i.e. Full HD, Quad HD & 4 K UHD respectively at 25 / 30 FPS for each type of camera both for the Primary & Secondary location(s) shall determine the capacity of the storage device at every location.</p> <p>The storage capacity shall be calculated keeping in view the spare capacity of 25% of the installed capacity.</p>
13	Chapter-2	18	18R	4.3 (5) (ii)	<p>Failure of any recording server shall not have any effect on availability of recording of any CCTV camera, as all the cameras are being simultaneously recorded, both at Primary server & Mirror recorded at Primary server of adjacent locations.</p>	<p>Failure of any recording server (either Primary or Adjacent for Mirror recording) shall not have any effect on availability of recording of any CCTV camera, as all the cameras are being simultaneously recorded, both at Primary and adjacent location(s).</p>
14	Chapter-2	20	20R	4.4.1 (16)	<p>It shall be possible to backup and restore system configuration in order to quickly restore the configuration of the video management system.</p> <p>Two types of backup of system configuration shall be possible:</p> <p>i) Scheduled backup, ii) Manual backup: System logs shall not be backed up or restored when performing manual backup or restore.</p>	<p>It shall be possible to backup and restore system configuration in order to quickly restore the configuration of the video management system.</p> <p>Two types of backup of system configuration shall be possible:</p> <p>i) Scheduled backup / Automatic Backup, ii) Manual backup: System logs shall not be backed up or restored when performing manual backup or restore.</p>

S.No.	Bid Document/ Chapter	Page Nos. (Original)	Revised Page Nos. (Ver.1)	Clause No.	Original Bid Conditions	Amended Bid Conditions
15	Chapter-2	20	20R	4.4.1 (17)	<p>System monitoring feature shall be available. The system monitoring feature shall give operators the possibility of viewing system information and creating reports on:</p> <p>i) Management servers, Recording servers, Failover servers which shall show CPU and memory usage of the servers.</p> <p>ii) Cameras, which shall show a minimum list of the following items:</p> <p>a) Camera status (connected or disconnected)</p> <p>b) an individual camera is recording or not</p> <p>c) The name of the camera, the hardware device and the IP address of the hardware device.</p> <p>d) The recording server the camera is connected to</p> <p>e) what storage the camera is using</p>	<p>Following features with a facility for viewing shall be monitored on the VMS client(s):</p> <p>i) Camera information (Name, Type and IP Address)</p> <p>ii) Camera status (Connected or disconnected)</p> <p>iii) Connectivity status between camera and associated NVR (Connected or disconnected)</p> <p>iv) Recording on Primary storage (Available or not)</p> <p>v) Recording on mirror storage at adjacent location (Available or not)</p> <p>vi) Identification of storage during playback (Primary or mirror)</p> <p>vii) Events triggered on camera i.e. ESP alarm, Emergency door open etc.</p>
16	Chapter-2	20	20R	4.4.2 (2)	<p>4.4.2 Alarm management features of VMS</p> <p>2) The alarm management feature shall be available in the viewing client. It shall allow alarms from Hardware, Software and 3rd Party Systems. The system shall allow configurable alarm escalation, alarm priority, etc.</p>	<p>4.4.2 Alarm management features of VMS Client.</p> <p>2) The system shall allow alarm escalation, alarm priority etc. The escalation & priority of alarms shall be configurable.</p>
17	Chapter-2	22	22R	4.5.4 (12)	get a quick overview of sequences with detected motion.	get a quick overview of sequences
18	Chapter-2	22	22R	4.5.4 (14)	print images, with optional comments.	print images
19	Chapter-2	NA	23R	4.5.4 (18) (New clause added)		The viewing client shall allow the user to be able to mute the audio recording of any camera during playback of video recording and also increase/decrease the volume of Audio recording.
20	Chapter-2	23	23R	4.5.5 (2)	The map function shall be able to use standard graphical file formats including: jpg, gif, png, tif, etc.	The map function shall be able to use any of the standard graphical file formats including: DWG, JPEG , jpg, gif, png, tif, etc
21	Chapter-2	23	23R	4.5.5 (3)	It shall be possible to use any number of layered maps and to easily drag-and-drop and point-and-click icons representing cameras, servers and PTZ presets to maps.	It shall be possible to use any number of layered maps with easy to use drag-and-drop and point-and-click icons in the maps representing cameras and servers.
22	Chapter-2	23	23R	4.5.7	<p>Mobile Viewing Client (at least 10 licenses)</p> <p>It shall be possible to access and view cameras and views on a Smartphone or a tablet (a mobile device) with similar functionalities mentioned above.</p>	<p>Mobile Viewing Client (at least 10 licenses)</p> <p>It shall be possible to access and view cameras and views on a Smartphone or a tablet (a mobile device) with all essential functionalities including</p>

S.No.	Bid Document/ Chapter	Page Nos. (Original)	Revised Page Nos. (Ver.1)	Clause No.	Original Bid Conditions	Amended Bid Conditions
						Camera list per location, Live viewing, Recording Playback, etc.
23	Chapter-2	23-24	24R	4.6 (1) Para 1	CCTV alarm & report management system shall be provided at OCC & BCC for effective status & alarm monitoring of all CCTV equipment i.e. Cameras, NVRs, Workstations & Central servers etc. and report generation of active failures pertaining to primary & mirror recording as also cameras, NVRs, workstations and central servers going Off-Line.	Alarm and Report management system shall be provided at OCC and BCC for monitoring status of hardware, software and 3rd party system(s) and alarm(s) of CCTV equipments i.e. Cameras, NVRs, Workstations & Central servers etc. and report generation of active failures pertaining to primary & mirror recording as also cameras, NVRs, workstations and central servers going Off-Line.
24	Chapter-2	29	29R	5.1.2 (5)	For ease of maintenance, the IP cameras and all software (Video management, CCTV Work-station & Video recording) shall preferably be from the same manufacturer/OEM.	For ease of maintenance, the IP cameras and all software (Video management, CCTV Work-station & Video recording) shall preferably be from the same manufacturer/OEM. In case of different OEMs for IP cameras and VMS softwares, both OEMs shall submit proof of satisfactory performance / working of their product with product of other OEM as per criteria specified in EQC clause 2.5 (2) for System specific OEM
25	Chapter-2	31	31R	5.2.1 (New clause added between sub-clause (3) & (4))	<p>1) Fixed Box Cameras: shall generally be used for indoor locations i.e. concourse, AFC Gates, platforms, platform staircases, Escalators, corridors, foot over bridges, cross passages, subways, ticketing area(s), Depot buildings etc.</p> <p>2) Fixed Box IR Cameras: shall generally be used for outdoor locations i.e. Staircase of Entry/Exit gates, Entry/Exit gates of Depot, Platform Tail-ends, Parking, periphery of RSS & Depot, SPCs, Ramp & River-Bridge etc.</p> <p>3) Fixed Dome IR Cameras: shall generally be used to provide coverage of TER gallery, Platform head-ends, Mid-Shafts, Emergency Exit, Fireman staircase exit, DG room at underground station, ESPs at platforms and station Control room etc.</p> <p>4) PTZ Dome IR Cameras: shall generally be used to provide wider coverage of station concourse & depot with Pan, Zoom & 180° Tilt facility so that Controller can monitor any desired location within its coverage area by manually adjusting it through Joystick/ Mouse.</p>	<p>1) Fixed Box Cameras: shall generally be used for indoor locations i.e. concourse, AFC Gates, platforms, platform staircases, Escalators, corridors, foot over bridges, cross passages, subways, ticketing area(s), Depot buildings etc.</p> <p>2) Fixed Box IR Cameras: shall generally be used for outdoor locations i.e. Staircase of Entry/Exit gates, Entry/Exit gates of Depot, Platform Tail-ends, Parking, periphery of RSS & Depot, SPCs, Ramp & River-Bridge etc.</p> <p>3) Fixed Dome IR Cameras: shall generally be used to provide coverage of TER gallery, Platform head-ends, Mid-Shafts, Emergency Exit, Fireman staircase exit, DG room at underground station, ESPs at platforms and station Control room etc.</p> <p>4) Bullet Cameras: shall generally be used for indoor locations i.e. Emergency exits, unpaid areas of concourse and DCC & ETU Building at Stations & Depots respectively.</p> <p>5) PTZ Dome IR Cameras: shall generally be used to provide wider coverage of station concourse & depot with Pan, Zoom & 180° Tilt facility so that Controller can</p>

S.No.	Bid Document/ Chapter	Page Nos. (Original)	Revised Page Nos. (Ver.1)	Clause No.	Original Bid Conditions	Amended Bid Conditions
						monitor any desired location within its coverage area by manually adjusting it through Joystick/ Mouse.
26	Chapter-2	34	34R	5.2.6	<p>Specifications for following IP Colour Cameras (Day/Night):</p> <ol style="list-style-type: none"> 1) Fixed Box IP Colour Camera (Quad HD or better). 2) Fixed Box IP Colour Camera (4K UHD or better). 3) Fixed Dome IP Colour Camera with IR illuminator (Quad HD or better) 4) High Speed, PTZ Dome IP Colour Camera (Quad HD or better). 5) Corner Lift IP Colour Camera (Full HD or better) (to be supplied by Lift Contractor) are enclosed at Annexure 5 of this document. 	<p>Specifications for following IP Colour Cameras (Day/Night):</p> <ol style="list-style-type: none"> 1) Fixed Box IP Colour Camera (Quad HD or better). 2) Fixed Box IP Colour Camera (4K UHD or better). 3) Fixed Dome IP Colour Camera with IR illuminator (Quad HD or better). 4) High Speed, PTZ Dome IP Colour Camera (Quad HD or better). 5) Corner Lift IP Colour Camera (Full HD or better) (to be supplied by Lift Contractor) except the quantities specifically included in the BoQ. 6) Bullet Camera (Quad HD or better) are enclosed at Annexure 5 of this document.
27	Chapter-2	35	35R	5.2.10 (1) (i)	<p>5.2.10 Network Video Recorder</p> <ol style="list-style-type: none"> 1) Network Video Recorder (Server/Storage) - General requirements <ol style="list-style-type: none"> i) The recording servers shall be used for recording video feeds/signals and for communicating with cameras and other devices. The recording server(s) shall be able to communicate with the management server. 	<p>5.2.10 Network Video Recorder</p> <ol style="list-style-type: none"> 1) Network Video Recorder (Server/Storage) - General requirements <ol style="list-style-type: none"> i) The recording servers shall be used for recording video & audio feeds/signals and for communicating with cameras and other devices. The recording server(s) shall be able to communicate with the management server.
28	Chapter-2	35	35R	5.2.10 (1) (iii)	Video stream from individual cameras shall be recorded on the storage device.	Video stream as well as audio stream (configured as per requirement) from individual cameras shall be recorded on the storage device.
29	Chapter-2	35	35R	5.2.10 (1) (iv)	The storage capacity of the NVR system shall be for recording for a min. of 7 days.	The storage capacity of the NVR system shall be for recording (audio & video) for a min. of 7 days.

S.No.	Bid Document/ Chapter	Page Nos. (Original)	Revised Page Nos. (Ver.1)	Clause No.	Original Bid Conditions	Amended Bid Conditions
30	Chapter-2	36	36R	5.2.10 (1) (xii)	<p>System should ensure that once recorded, the video cannot be altered, ensuring the audit trail is intact for evidential purposes.</p> <p>Water marking alone for ensuring tamper proof recording is not sufficient and this shall be additionally achieved using Authentication with SHA-256 hashing function or latest, secured with 1024-bit RSA public-private key pair encryption. The VMS must support digital signature to prove authentication and integrity. Tamper proof recording mechanism which meets security of minimum 128 bits encryption shall be implemented.</p>	<p>System should ensure that once recorded, the video cannot be altered, ensuring the audit trail is intact for evidential purposes.</p> <p>Water marking alone for ensuring tamper proof recording is not sufficient and this shall be additionally achieved using Authentication with minimum SHA-256 hashing function or latest, secured with 1024-bit RSA public-private key pair encryption. The VMS must support digital signature to prove authentication and integrity. Tamper proof recording mechanism which meets security of minimum AES-128 encryption shall be implemented.</p>
31	Chapter-2	37	37R	5.2.10 (2) (iii) Table 2.11 (5)	<p>Table 2.11: NVR Servers Specifications</p> <p>5) OS hard drive Minimum 2 x 512 GB SSD in RAID 1 Random Read IOPS (QD1) – up-to 14,000 IOPS Random write IOPS (QD1) – up-to 50,000 IOPS</p>	<p>Table 2.11: NVR Servers Specifications</p> <p>5) OS hard drive Minimum 2 x 480 GB SSD in RAID 1 Random Read IOPS (QD1) – up-to 14,000 IOPS Random write IOPS (QD1) – up-to 50,000 IOPS</p>
32	Chapter-2	37	37R	5.2.10 (2) (iii) Table 2.11 (7)	<p>Table 2.11: NVR Servers Specifications</p> <p>7) Drive controller Dual SAS controller with RAID 5 or better (in redundant configuration)</p>	<p>Table 2.11: NVR Servers Specifications</p> <p>7) Drive controller Dual SAS controller with RAID 5 or better (separate for each RAID group)</p>
33	Chapter-2	37	37R	5.2.10 (2) (iii) Table 2.11 (12)	<p>Table 2.11: NVR Servers Specifications</p> <p>12) OS Latest Windows Server/Linux/Sun Solaris or as required for CCTV system operation.</p>	<p>Table 2.11: NVR Servers Specifications</p> <p>12) OS Latest Windows Server/Linux or as required for CCTV system operation.</p>
34	Chapter-2	40	40R	5.2.12 Table 2.12 (1)	<p>Table 2.12: VMS & Alarm Management Servers Specifications</p> <p>1) Processor - Latest Intel Xeon scalable dual processor (3.2 Ghz or better) with Hyper-Threading with minimum 10.4 GT/sec QPI speed, 20MB L3 cache, configured with Redundant Power Supplies</p>	<p>Table 2.12: VMS & Alarm Management Servers Specifications</p> <p>1) Processor - Latest Intel Xeon scalable dual processor (3.2 Ghz or better) with Hyper-Threading with minimum 10.4 GT/sec QPI speed, 18MB L3 cache, configured with Redundant Power Supplies</p>
35	Chapter-2	47	47R	Annexure-1	Contract Spares (CCTV System)	Quantities amended
36	Chapter-2	50	50R	Annexure-4	<p>Quantities of various types of Cameras & their Locations (typical) planned at every;</p> <ol style="list-style-type: none"> 1) Elevated station 2) Underground stations 3) Depots 4) Miscellaneous Locations 5) Summary of Cameras per Location (Typical) and Total no. of Cameras for all locations (Phase-IV) 	Quantities amended

S.No.	Bid Document/ Chapter	Page Nos. (Original)	Revised Page Nos. (Ver.1)	Clause No.	Original Bid Conditions	Amended Bid Conditions
37	Chapter-2	54-57	54R-59R	Annexure 5 (a)	Specifications for Fixed Box IP Colour Cameras (Quad HD & 4K UHD)	Specifications for Bullet Cameras (Quad HD or better) has been included
38	Chapter-2	54	54R	Annexure 5 (a) (S.No. 1) (Fixed Box - Quad HD)	Fixed Box IP Colour Camera (Quad HD or better) 1) Image Sensor - 1/2.8" or bigger, CMOS progressive scan image sensor, P-Iris sensor	Fixed Box IP Colour Camera (Quad HD or better) 1) Image Sensor - 1/2.8" or bigger, CMOS progressive scan image sensor, P-Iris / Auto-Iris sensor
39	Chapter-2	54	54R	Annexure 5 (a) (S.No. 1) (Fixed Box - 4K UHD)	Fixed Box IP Colour Camera (4K UHD or better) 1) Image Sensor - 1/2.8" or bigger, CMOS progressive scan image sensor, P-Iris sensor	Fixed Box IP Colour Camera (4K UHD or better) 1) Image Sensor - 1/2" or bigger, CMOS progressive scan image sensor, P-Iris / Auto-Iris sensor
40	Chapter-2	54	54R	Annexure 5 (a) (S.No. 4) (Fixed Box - Quad HD & 4K UHD)	Specifications for Fixed Box IP Colour Cameras (Quad HD & 4K UHD) 4) Compression method: H.264 & H.265 or better (as available)	Specifications for Fixed Box IP Colour Cameras (Quad HD & 4K UHD) 4) Compression method: H.264 / H.265 or better
41	Chapter-2	54	54R	Annexure 5 (a) (S.No. 5) (Fixed Box - Quad HD)	Fixed Box IP Colour Cameras (Quad HD or better) 5) Video streaming Min. Three (3) video streams with H.265 or better compression with: - 25/30 FPS - Intelligent streaming - The streams shall be configurable as unicast or multicast and all of them shall be configurable/ dynamically adaptable from SD to Quad HD - At any given time, output of min. two streams shall be Quad HD with the 3rd stream as FHD.	Fixed Box IP Colour Cameras (Quad HD or better) 5) Video streaming Min. Three (3) video streams with H.264 / H.265 or better compression with: i) 25/30 FPS ii) Intelligent streaming iii) The streams shall be configurable as unicast or multicast, and all of them shall be configurable/ dynamically adaptable from SD to Quad HD. iv) At any given time, following streams shall be available: a) 1st stream - Quad HD b) 2nd stream - Full HD c) 3rd stream - SD
42	Chapter-2	54	54R	Annexure 5 (a) (S.No. 5) (Fixed Box - 4K UHD)	Fixed Box IP Colour Cameras (4K UHD or better) 5) Video streaming Min. Three (3) video streams with H.265 or better compression with: - 25/30 FPS - Intelligent streaming - The streams shall be configurable as unicast or multicast, and all of them shall be configurable/ dynamically adaptable from SD to 4K. - At any given time, output of min. one stream shall be 4K with 2nd and 3rd stream as Quad HD and FHD respectively.	Fixed Box IP Colour Cameras (4K UHD or better) 5) Video streaming Min. Three (3) video streams with H.264 / H.265 or better compression with: i) 25/30 FPS ii) Intelligent streaming iii) The streams shall be configurable as unicast or multicast, and all of them shall be configurable/ dynamically adaptable from SD to 4K. iv) At any given time, following streams shall be available: a) 1st stream - Ultra HD (4k) b) 2nd stream - Full HD c) 3rd stream - SD

S.No.	Bid Document/ Chapter	Page Nos. (Original)	Revised Page Nos. (Ver.1)	Clause No.	Original Bid Conditions	Amended Bid Conditions
43	Chapter-2	54	54R	Annexure 5 (a) (S.No. 6) (Fixed Box - Quad HD & 4K UHD)	<p>Specifications for Fixed Box IP Colour Cameras (Quad HD & 4K UHD)</p> <p>6) Sensitivity @ 30 IRE F1.4 (if AGC is off)</p> <p>a) Colour Mode 0.10 Lux</p> <p>b) Monochrome mode 0.05 Lux</p>	<p>Specifications for Fixed Box IP Colour Cameras (Quad HD & 4K UHD)</p> <p>6) Sensitivity @ 30 IRE F1.4 - F1.6 (if AGC is off)</p> <p>a) Colour Mode 0.10 Lux</p> <p>b) Monochrome mode 0.05 Lux</p>
44	Chapter-2	54-55	55R	Annexure 5 (a) (S.No. 11) (Fixed Box - Quad HD & 4K UHD)	<p>Specifications for Fixed Box IP Colour Cameras (Quad HD & 4K UHD)</p> <p>11) Motorized Varifocal Lens:</p> <p>Integrated Lens – shall comply to specifications given for varifocal lenses.</p> <p>Separate Lens – Shall be compatible with the Fixed Box IP camera & comply to specifications given for Varifocal lenses.</p>	<p>Specifications for Fixed Box IP Colour Cameras (Quad HD & 4K UHD)</p> <p>11) Motorized Varifocal Lens:</p> <p>Separate Lens – Shall be compatible with the Fixed Box IP camera & comply to specifications given for Varifocal lenses.</p>
45	Chapter-2	55	55R	Annexure 5 (a) (S.No. 12) (Fixed Box - Quad HD & 4K UHD)	<p>Specifications for Fixed Box IP Colour Cameras (Quad HD & 4K UHD)</p> <p>12) Infra-Red (If required with the Camera)</p> <p>Built-in Infra-Red illuminator with range of 50 mtrs. or more shall be as per specifications for IR illuminator given in Para 5 of these specifications. (only applicable for camera with integrated lens) In case of External</p> <p>IR illuminator with range of 50 mtrs. or more, shall be fully compatible with the Housing & the Camera and shall be as per specifications for IR illuminator given in Para 5 of these specifications.</p>	<p>Specifications for Fixed Box IP Colour Cameras (Quad HD & 4K UHD)</p> <p>12) Infra-Red (If required with the Camera)</p> <p>Infra-Red illuminator with range of 50 mtrs. or more shall be as per specifications for IR illuminator given in Para 5 of these specifications.</p> <p>IR illuminator shall be fully compatible with the Housing & the Camera.</p>

S.No.	Bid Document/ Chapter	Page Nos. (Original)	Revised Page Nos. (Ver.1)	Clause No.	Original Bid Conditions	Amended Bid Conditions
46	Chapter-2	56	57R	Annexure 5 (a) (S.No. 34) (Fixed Box - Quad HD & 4K UHD)	<p>Specifications for Fixed Box IP Colour Cameras (Quad HD & 4K UHD)</p> <p>34) Alarm Inputs/ outputs</p> <p>1 input & 1 output (compatible for ESP-CCTV and Telephone-CCTV interface as defined in PS). Cameras shall have inbuilt provision to receive input from Normal open/Normal Close potential free contact.</p>	<p>Specifications for Fixed Box IP Colour Cameras (Quad HD & 4K UHD)</p> <p>34) Inputs/ Outputs (min.)</p> <p>a) Alarms</p> <p>1 Input - Compatible with ESP-CCTV or Telephone - CCTV interface as defined in Chapter-3 – Interface (Roles & Responsibilities). Cameras shall have inbuilt provision to receive Input from Normal open/Normal Close potential free contacts.</p> <p>1 Output – Details to be submitted during design stage for approval of the Engineer.</p> <p>34) Inputs/ Outputs (min.)</p> <p>(b) Audio</p> <p>Line input - compatible for external Microphone. Details of the Input port to be provided.</p> <p>Line output - Details to be submitted during design stage for approval of the Engineer</p> <p>Streaming - Bidirectional Full duplex, Compression - G.711 or better Microphones - Either inbuilt Microphones shall be provided in the cameras or min. 2% cameras shall be provided with compatible external Microphones</p>
47	Chapter-2	57	59R	Annexure 5 (a) (S.No. 46) (Fixed Box - Quad HD & 4K UHD)	<p>Specifications for Fixed Box IP Colour Cameras (Quad HD & 4K UHD)</p> <p>46) Makes for Cameras</p> <p>Pelco, Axis, Avigilon, GE, Indigo vision, Panasonic, Bosch, Sony, Honeywell, Siemens, Dvtel or equivalent subject to meeting the above specs. Printed data sheet of manufacturer shall be attached with the bid proposal, clearly identifying clause by clause compliance.</p>	<p>Specifications for Fixed Box IP Colour Cameras (Quad HD & 4K UHD)</p> <p>46) Makes for Cameras</p> <p>Pelco, Axis, Avigilon, GE, Indigo vision, Panasonic, Bosch, Sony, Honeywell, Siemens, Dvtel, Tyco or equivalent subject to meeting the above specs. Printed data sheet of manufacturer shall be attached with the bid proposal, clearly identifying clause by clause compliance.</p>
48	Chapter-2	58	60R	Annexure 5 (b) (S.No. 1) (Fixed Dome)	<p>Fixed Dome IP Colour Camera with IR illuminator (Quad HD or better)</p> <p>1) Image Sensor:</p> <p>1/2.8" or bigger, CMOS sensor, Progressive scan</p>	<p>Fixed Dome IP Colour Camera with IR illuminator (Quad HD or better)</p> <p>1) Image Sensor:</p> <p>1/2.9" or bigger, CMOS sensor, Progressive scan</p>
49	Chapter-2	58	60R	Annexure 5 (b) (S.No. 1) (PTZ)	<p>High Speed, PTZ Dome IP Colour Camera (Quad HD or better)</p> <p>1) Image Sensor</p> <p>1/2.8" or bigger, CMOS progressive scan image sensor, P-Iris sensor</p>	<p>High Speed, PTZ Dome IP Colour Camera (Quad HD or better)</p> <p>1) Image Sensor</p> <p>1/2.8" or bigger, CMOS progressive scan image sensor, P-Iris / Auto-Iris sensor</p>

S.No.	Bid Document/ Chapter	Page Nos. (Original)	Revised Page Nos. (Ver.1)	Clause No.	Original Bid Conditions	Amended Bid Conditions
50	Chapter-2	58	60R	Annexure 5 (b) (S.No. 1) (Lift Camera)	Corner Lift IP Colour Camera (Full HD or better) 1) Image Sensor 1/2.8" or bigger, CMOS progressive scan image sensor, P-Iris sensor	Corner Lift IP Colour Camera (Full HD or better) 1) Image Sensor 1/2.8" or bigger, CMOS progressive scan image sensor
51	Chapter-2	58	60R	Annexure 5 (a) (S.No. 4) (Fixed Dome, PTZ & Lift Camera)	Specifications for Fixed Box Dome, High Speed, PTZ Dome & Lift IP Colour Cameras: 4) Compression method: H.264 & H.265 or better (as available)	Specifications for Fixed Box Dome, High Speed, PTZ Dome & Lift IP Colour Cameras: 4) Compression method: H.264 / H.265 or better
52	Chapter-2	58	60R	Annexure 5 (b) (S.No. 5) (Fixed Dome)	Fixed Dome IP Colour Camera with IR illuminator (Quad HD or better) 5) Video streaming Min. Three (3) video streams with H.265 or better compression with: - 25/30 FPS - Intelligent streaming - The streams shall be configurable as unicast or multicast and all of them shall be configurable/ dynamically adaptable from SD to Quad HD - At any given time, output of min. two streams shall be Quad HD with the 3rd stream as FHD.	Fixed Dome IP Colour Camera with IR illuminator (Quad HD or better) 5) Video streaming Min. Three (3) video streams with H.264 / H.265 or better compression with: i) 25/30 FPS ii) Intelligent streaming iii) The streams shall be configurable as unicast or multicast, and all of them shall be configurable/ dynamically adaptable from SD to Quad HD. iv) At any given time, following streams shall be available: a) 1st stream :- Quad HD b) 2nd stream :- Full HD c) 3rd stream :- SD
53	Chapter-2	58	60R	Annexure 5 (b) (S.No. 5) (PTZ)	High Speed, PTZ Dome IP Colour Camera (Quad HD or better) 5) Video streaming Min. Three (3) video streams with H.265 or better compression with: - 25/30 FPS - Intelligent streaming - The streams shall be configurable as unicast or multicast and all of them shall be configurable/ dynamically adaptable from SD to Quad HD - At any given time, output of min. two streams shall be Quad HD with the 3rd stream as FHD.	High Speed, PTZ Dome IP Colour Camera (Quad HD or better) 5) Video streaming Min. Three (3) video streams with H.264 / H.265 or better compression with: i) 25/30 FPS ii) Intelligent streaming iii) The streams shall be configurable as unicast or multicast, and all of them shall be configurable/ dynamically adaptable from SD to Quad HD. iv) At any given time, following streams shall be available: a) 1st stream: - Quad HD b) 2nd stream: - Full HD c) 3rd stream: - SD

S.No.	Bid Document/ Chapter	Page Nos. (Original)	Revised Page Nos. (Ver.1)	Clause No.	Original Bid Conditions	Amended Bid Conditions
54	Chapter-2	58	60R	Annexure 5 (b) (S.No. 5) (Lift Camera)	<p>Corner Lift IP Colour Camera (Full HD or better)</p> <p>(5) Video streaming</p> <p>Min. Three (3) video streams with H.265 or better compression with:</p> <ul style="list-style-type: none"> - 25/30 FPS - Intelligent streaming - The streams shall be configurable as unicast or multicast and all of them shall be configurable/ dynamically adaptable from SD to Full HD - At any given time, output of min. two streams shall be Full HD with the 3rd stream as SD 	<p>Corner Lift IP Colour Camera (Full HD or better)</p> <p>(5) Video streaming</p> <p>Min. Three (3) video streams with H.264 / H.265 or better compression with:</p> <ul style="list-style-type: none"> i) 25/30 FPS ii) Intelligent streaming iii) The streams shall be configurable as unicast or multicast, and all of them shall be configurable/ dynamically adaptable from SD to Full HD. iv) At any given time, following streams shall be available: <ul style="list-style-type: none"> a) 1st stream: - Full HD b) 2nd stream: - Full HD c) 3rd stream: - SD
55	Chapter-2	58	60R	Annexure 5 (b)(S.No. 6)(Fixed Dome, PTZ & Lift Camera)	<p>Specifications for Fixed Box Dome, High Speed, PTZ Dome & Lift IP Colour Cameras:</p> <p>6) Sensitivity @ 30 IRE F1.4 (if AGC is off)</p> <ul style="list-style-type: none"> a) Colour Mode 0.10 Lux b) Monochrome mode 0.05 Lux 	<p>Specifications for Fixed Box Dome, High Speed, PTZ Dome & Lift IP Colour Cameras:</p> <p>6) Sensitivity @ 30 IRE F1.4 - F1.6 (if AGC is off)</p> <ul style="list-style-type: none"> a) Colour Mode 0.3 Lux b) Monochrome mode 0.05 Lux
56	Chapter-2	58	61R	Annexure 5 (b) (S.No. 9) (Fixed Dome)	<p>Fixed Dome IP Colour Camera with IR illuminator (Quad HD or better)</p> <p>9) Angle of View (Horizontal &Vertical)</p> <p>90° X 60° (min.)</p>	<p>Fixed Dome IP Colour Camera with IR illuminator (Quad HD or better)</p> <p>9) Angle of View (Horizontal &Vertical)</p> <p>89° X 47°(min.)</p>
57	Chapter-2	58	61R	Annexure 5 (b) (S.No. 9) (Lift Camera)	<p>Corner Lift IP Colour Camera (Full HD or better)</p> <p>9) Angle of View (Horizontal &Vertical)</p> <p>115° X 85° (min.)</p>	<p>Corner Lift IP Colour Camera (Full HD or better)</p> <p>9) Angle of View (Horizontal &Vertical)</p> <p>115° X 77° (min.)</p>
58	Chapter-2	59	61R	Annexure 5 (b) (S.No. 11) (Fixed Dome)	<p>Fixed Dome IP Colour Camera with IR illuminator (Quad HD or better)</p> <p>11) Motorized Varifocal Lens</p> <p>Integrated Vari-focal lens 2.8mm-12mm, F 1.4, IR corrected, Day/Night, Motorised Auto Back-Focus Auto DC Iris</p>	<p>Fixed Dome IP Colour Camera with IR illuminator (Quad HD or better)</p> <p>11) Motorized Varifocal Lens</p> <p>Integrated Vari-focal lens 3.2mm-10mm, F1.4 - F1.6, IR corrected, Day/Night, Motorised Auto Back-Focus, Auto DC Iris</p>
59	Chapter-2	59	61R	Annexure 5 (b) (S.No. 12) (Fixed Dome)	<p>Fixed Dome IP Colour Camera with IR illuminator (Quad HD or better)</p> <p>12) Infra-Red (If required with the Camera)</p> <p>Built-in Infra-Red illuminator, with range of 50 mtrs. or more, shall be as per specifications for IR illuminator given in Para 5 of these specifications.</p>	<p>Fixed Dome IP Colour Camera with IR illuminator (Quad HD or better)</p> <p>12) Infra-Red (If required with the Camera)</p> <p>Fixed Dome: Built-in Infra-Red illuminator, with range of 30 mtrs. or more.</p>
60	Chapter-2	59	61R	Annexure 5 (b) (S.No. 18) (PTZ)	<p>High Speed, PTZ Dome IP Colour Camera (Quad HD or better)</p> <p>18) Sector Blanking</p> <p>360° Pan rotation to be divided in 32 individually configurable Privacy</p>	<p>High Speed, PTZ Dome IP Colour Camera (Quad HD or better)</p> <p>18) Sector Blanking</p> <p>360° Pan rotation to be divided in 24 individually configurable Privacy Masks/Zones as required by operator.</p>

S.No.	Bid Document/ Chapter	Page Nos. (Original)	Revised Page Nos. (Ver.1)	Clause No.	Original Bid Conditions	Amended Bid Conditions
					Masks/Zones as required by operator.	
61	Chapter-2	61	63R	Annexure 5 (b) (S.No. 34) (Fixed Dome, PTZ & Lift Camera)	<p>Specifications for Fixed Box Dome, High Speed, PTZ Dome & Lift IP Colour Cameras:</p> <p>34) Alarm Inputs/ outputs</p> <p>1 input & 1 output (compatible for ESP-CCTV and Telephone-CCTV interface as defined in PS). Cameras shall have inbuilt provision to receive input from Normal open/Normal Close potential free contact.</p>	<p>Specifications for Fixed Box Dome, High Speed, PTZ Dome & Lift IP Colour Cameras:</p> <p>34) Inputs/ Outputs (min.)</p> <p>(a) Alarms</p> <p>1 Input - Compatible with ESP-CCTV or Telephone - CCTV interface as defined in Chapter-3 – Interface (Roles & Responsibilities). Cameras shall have inbuilt provision to receive Input from Normal open/Normal Close potential free contacts.</p> <p>1 Output – Details to be submitted during design stage for approval of the Engineer.</p> <p>(34) Inputs/ Outputs (min.)</p> <p>(b) Audio</p> <p>Line input - compatible for external Microphone. Details of the Input port to be provided.</p> <p>Line output - Details to be submitted during design stage for approval of the Engineer</p> <p>Streaming - Bidirectional Full duplex, Compression - G.711 or better</p> <p>Microphones - Either inbuilt Microphones shall be provided in the cameras or min. 2% cameras shall be provided with compatible external Microphones</p>
62	Chapter-2	62	64R	Annexure 5 (b) (S.No. 46) (Fixed Dome, PTZ & Lift Camera)	<p>Specifications for Fixed Box Dome, High Speed, PTZ Dome & Lift IP Colour Cameras:</p> <p>46) Makes for Cameras</p> <p>Pelco, Axis, Avigilon, GE, Indigoision, Panasonic, Bosch, Sony, Honeywell, Siemens, Dvtel or equivalent subject to meeting the above specs. Printed data sheet of manufacturer shall be attached with the bid proposal, clearly identifying clause by clause compliance.</p>	<p>Specifications for Fixed Box Dome, High Speed, PTZ Dome & Lift IP Colour Cameras:</p> <p>46) Makes for Cameras</p> <p>Pelco, Axis, Avigilon, GE, Indigoision, Panasonic, Bosch, Sony, Honeywell, Siemens, Dvtel, Tyco or equivalent subject to meeting the above specs. Printed data sheet of manufacturer shall be attached with the bid proposal, clearly identifying clause by clause compliance.</p>
63	Chapter-2	64	66R	Annexure 6 (2) Table 2.14 (S.No.2)	<p>REQUIREMENTS OF FULL HD LASER VIDEO WALL (SIZE: 5X2 X70")</p> <p>2) TECHNICAL SPECIFICATIONS</p> <p>(i) Laser Video wall:</p> <p>Table 2.14: Laser Video Specifications</p> <p>2. Light source</p> <p>RGB Laser, without color wheel</p>	<p>REQUIREMENTS OF FULL HD LASER VIDEO WALL (SIZE: 5X2 X70")</p> <p>2) TECHNICAL SPECIFICATIONS</p> <p>(i) Laser Video wall:</p> <p>Table 2.14: Laser Video Specifications</p> <p>2. Light source</p> <p>RGB Laser, preferably without colour wheel. In event of proposing a solution</p>

S.No.	Bid Document/ Chapter	Page Nos. (Original)	Revised Page Nos. (Ver.1)	Clause No.	Original Bid Conditions	Amended Bid Conditions
						with colour wheel, the contractor shall submit detailed explanation for the same along with its advantages to the Engineer for review & approval. Decision of the Engineer shall be final.
64	Chapter-2	64	66R	Annexure 6 (2) Table 2.14 (S.No.9)	REQUIREMENTS OF FULL HD LASER VIDEO WALL (SIZE: 5X2 X70") 2) TECHNICAL SPECIFICATIONS (i) Laser Video wall: Table 2.14: Laser Video Specifications 9. Brightness (typical): 250 cd/m2	REQUIREMENTS OF FULL HD LASER VIDEO WALL (SIZE: 5X2 X70") 2) TECHNICAL SPECIFICATIONS (i) Laser Video wall: Table 2.14: Laser Video Specifications 9. Brightness (typical): 500 cd/m2
65	Chapter-2	64	66R	Annexure 6 (2) Table 2.14 (S.No.12)	REQUIREMENTS OF FULL HD LASER VIDEO WALL (SIZE: 5X2 X70") 2) TECHNICAL SPECIFICATIONS (i) Laser Video wall: Table 2.14: Laser Video Specifications 12. Power Usage per module: Max. 200 Watt	REQUIREMENTS OF FULL HD LASER VIDEO WALL (SIZE: 5X2 X70") 2) TECHNICAL SPECIFICATIONS (i) Laser Video wall: Table 2.14: Laser Video Specifications 12. Power consumption per module: 350 Watt (max.)
66	Chapter-2	64	66R	Annexure 6 (2) Table 2.14 (S.No.17)	REQUIREMENTS OF FULL HD LASER VIDEO WALL (SIZE: 5X2 X70") 2) TECHNICAL SPECIFICATIONS (i) Laser Video wall: Table 2.14: Laser Video Specifications 17. Video Inputs per Module: 1 x DP1.2 Input 1 x HDMI Input	REQUIREMENTS OF FULL HD LASER VIDEO WALL (SIZE: 5X2 X70") 2) TECHNICAL SPECIFICATIONS (i) Laser Video wall: Table 2.14: Laser Video Specifications 17. Video Inputs per Module: 2 x DP1.2 / HDMI Input - with compatible converter
67	Chapter-2	64	66R	Annexure 6 (2) Table 2.14 (S.No.18)	REQUIREMENTS OF FULL HD LASER VIDEO WALL (SIZE: 5X2 X70") 2) TECHNICAL SPECIFICATIONS (i) Laser Video wall: Table 2.14: Laser Video Specifications 18. Video outputs per Module: 1 x DP1.2 Output 1 x HDMI Output	REQUIREMENTS OF FULL HD LASER VIDEO WALL (SIZE: 5X2 X70") 2) TECHNICAL SPECIFICATIONS (i) Laser Video wall: Table 2.14: Laser Video Specifications 18. Video outputs per Module: 1 x DP1.2 Output or 1 x HDMI Output
68	Chapter-2	65	67R	Annexure 6 (2) Table 2.15 (S.No.17)	REQUIREMENTS OF FULL HD LASER VIDEO WALL (SIZE: 5X2 X70") 2) TECHNICAL SPECIFICATIONS ii) Display Controller: Table 2.15: Laser Video Specifications 17. Makes & Approvals One of the reputed makes such as IBM, Dell, HP, Fujitsu, Sun Microsystems or equivalent subject to meeting the above specifications. CE/FCC/UL Certification required.	REQUIREMENTS OF FULL HD LASER VIDEO WALL (SIZE: 5X2 X70") 2) TECHNICAL SPECIFICATIONS ii) Display Controller: Table 2.15: Laser Video Specifications 17. Makes & Approvals - One of the reputed makes such as IBM, Dell, HP, Fujitsu, Sun Microsystems or equivalent subject to meeting the above specifications. - CE/FCC/UL / BIS Certification required.

S.No.	Bid Document/ Chapter	Page Nos. (Original)	Revised Page Nos. (Ver.1)	Clause No.	Original Bid Conditions	Amended Bid Conditions
69	Chapter-2	65	67R	Annexure 6 (2) (ii) (d)	<p>REQUIREMENTS OF FULL HD LASER VIDEO WALL (SIZE: 5X2 X70")</p> <p>2) TECHNICAL SPECIFICATIONS</p> <p>ii) Display Controller:</p> <p>d) The decoder unit shall have a dual 100/1000 Base-T failover Ethernet interface. The decoder unit shall support IP, and TCP video stream formats. Each Decoding unit shall decode up to a maximum of 24 Streams.</p>	<p>REQUIREMENTS OF FULL HD LASER VIDEO WALL (SIZE: 5X2 X70")</p> <p>2) TECHNICAL SPECIFICATIONS</p> <p>ii) Display Controller:</p> <p>d) The decoder unit shall have a dual 100/1000 Base-T failover Ethernet interface. The decoder unit shall support IP, and TCP video stream formats. Each Decoding unit shall decode up to 24 / 48 Streams.</p>



Table of Contents		
Clause Number	Description of Content	Page Number
1.	Introduction	2R
1.1	General	2R
1.2	Overview of Closed-Circuit Television (CCTV) System	2R
2.	Scope of the Works	7R
2.1	General	7R
2.2	Scope of Supply	7R
2.3	Scope of Services	8R
2.4	Scope of Services excluded in this contract	9R
3.	Performance Requirements	10R
3.1	General	10R
3.2	Reliability	10R
3.3	Availability	10R
3.4	Maintainability	10R
3.5	System Safety	11R
3.6	System Specific Performance	11R
4.	Functional Requirements	12R
4.1	General	12R
4.2	CCTV Coverage	15R
4.3	Network Video Recording System	17R
4.4	Video Management Server	19R
4.5	Viewing Client	22R
4.6	Network Management System	24R
4.7	DLP Based Laser Video wall (Full HD)	24R
4.8	Video Analytics	25R
4.9	System Redundancy and Protection	26R
4.10	Network Synchronization	27R
4.11	Network Security	27R
5.	Design Requirements	29R
5.1	General	29R
5.2	Equipment Specifications	31R
5.3	Equipment Design	41R
5.4	Cabling & Accessories	42R
5.5	Power Supply Distribution	42R
5.6	Surge protection & Earthing Arrangement	43R
5.7	System Expansion	44R
6.	Interface Requirements	45R
6.1	General	45R
6.2	Interface Specifications	45R
Annex 1	Contract Spares	47R
Annex 2	Special Tools & Test Equipment	48R
Annex 3	Tentative Backbone Network at Stations – CCTV System	49R
Annex 4	Quantities & Location of various types of cameras	50R
Annex 5a	Specifications of Fixed Box and Bullet IP Colour Cameras	54R
Annex 5b	Specifications of Fixed Dome, PTZ Dome & Lift IP Colour Cameras	60R
Annex 6	Requirements of Full HD Laser Video wall (Size: 5x2x70")	65R

**1. INTRODUCTION****1.1 GENERAL**

1.1.1 This Chapter of the Particular Specification specifies the particular requirements of the Closed-Circuit Television System of the Telecommunications System.

1.1.2 Requirements specified in this Chapter-2, shall be read in conjunction with other Chapters incl. Chapter 1 of this Particular Specification (PS), General Specification (GS), General Conditions (GC), Particular Conditions (PC), Instructions to Bidders (ITB) and other documents forming part of the contract.

1.2 OVERVIEW OF CLOSED-CIRCUIT TELEVISION SYSTEM

1.2.1 CCTV system is required to be provided to ensure effective surveillance of an area as well as to create tamper proof video recording for post event analysis.

1.2.2 Video surveillance system shall be an end to end IP Based system equipped with high definition & high-resolution cameras.

1.2.3 The CCTV System shall display images and be monitored locally from the Station/Location and remotely from OCC/BCC.

1.2.4 The CCTV system provided shall include all sub-system(s) required for surveillance & monitoring of following areas in the metro system:

- 1) **Station Surveillance:** Entire station area including following locations:

Table 2.1: Location of Coverage Areas

LOCATION	COVERAGE AREAS*
Concourse	Complete Concourse area, AFC gates, TOM, EFO/Customer care, TER gallery, SCR, staircase, Escalators, Lift Cars, Fire/Emergency exits, TVMs etc.
Platform	Complete length of platforms, All coaches/PSDs, Track end and Head end, Staircase, Escalators, ESP/PSB, Help phones, Lift Cars, Fire/Emergency exits etc.
Ground	AFC gates, TOM, EFO/Customer care, TER gallery, SCR TVMs, Entries/Exits, Escalators, Lift Cars, Fire/Emergency exits, Parking, DG room in Underground station only etc.
Interchange Area	Cross Passages, FOBs, Corridors, Galleries, Subways, EFO, AFC Gates, Travellators etc.

Note: * - Location of these coverage areas can differ, based on the final station design.

- 2) **Important Locations:** Important locations outside the stations like RSS, Mid-shaft, Ramp, Parking, FOBs, both ends of River Bridges, Cross Passages, Subways and specifically identified theft prone areas (at grade alignment) etc.

Night Vision (IR illuminated) cameras are to be provided at all these locations.

Locations of RSS, Mid-shaft, Ramp, Parking FOB(s) & River-Bridge etc. are detailed in Appendix-C of Chapter-4 (Appendices) of this PS.

- 3) **Depot Surveillance:** Important locations in all Depots
- 4) **OCC & BCC:** Important locations in OCC & BCC.
- 5) **Signalling Asset Surveillance:** All points & crossings, point machines tracks (interlocking station) shall be monitored using Night Vision (IR illuminated) cameras. List of interlocking station(s) along with Tentative number of Points& Crossings is given in Appendix-C of Chapter-4 (Appendices) of this PS.

1.2.5 The station surveillance CCTV system along with live and recorded videos shall be accessed simultaneously from following locations as a minimum:



- 1) **At Station**
 - i) Station Control Room
 - ii) Station Security Control Room
 - iii) Platform Supervisor Booth (as per Appendix-C of Chapter-4 (Appendices))
- 2) **At OCC**
 - i) OCC Controllers (Traffic controllers/Chief Controller/Assistant to Chief Controller/Traction Power Controller/Fault Management Controller etc.) of the concerned OCC.
 - ii) Security Controllers in Security Control Room
- 3) **At BCC**
 - i) BCC Controllers (Traffic controllers/Chief Controller/Assistant to Chief Controllers, etc).
 - ii) Security Controller in Security Control Room
- 4) **At DCC**
 - i) Depot Control Centre (DCC) and
 - ii) Security Control Room
- 5) **At RSS–RSS Controller**

1.2.6 Provision of MMIs for all the above locations is specified in Appendix-G of Chapter-4 (Appendices) of these Specifications

The CCTV workstation(s) /MMI(s) shall be provided as tabulated below:

Table 2.2: MMI Details

Location	Controller Position	MMI monitors	Cameras to monitor simultaneously (nos.)
Station	Station Control Room	Dual 24" 4K Monitors	50
	Security Control Room	Dual 32" 4K Monitors	50
	Platform Supervisory Booth	Dual 24" 4K Monitors	50
Depot	Depot Control Room	Dual 24" 4K Monitors	50
	Security Control room	Dual 32" 4K Monitors	50
OCC/ BCC	Control Centre	Single 24" 4K Monitor	25
	CSS	Dual 24" 4K Monitors	50
	Security Control Room	Dual 24" 4K Monitors	50
RSS	RSS Control Room	Dual 32" 4K Monitors	50

1.2.7 CCTV Workstations / MMIs shall normally be installed at the Operational locations (OCC, BCC, SCR, PCR, PSB, RSS, Security Room, CSS etc.) only if suitable arrangements are available/made for safety / security of the work-stations. This arrangement can be made by using Modular furniture equipped with Power strip, exhaust / ventilation fan & Locking arrangements. At all such locations the work-stations shall be connected to the network / server using dual (redundant) ethernet (Electrical / Optical) ports. USB based Key Board & Mouse shall be provided for all the MMIs.

1.2.8 At all other locations, where the Work-stations are located in an unsecured / unprotected environment, MMIs shall be extended from the Workstation / Server, located in the TER/CER/RSS control room (as the case may be) , using KVM (Key Board, VDU, Mouse) and suitable KVM-HDMI extenders for dual monitor MMIs and KVM extenders for single



monitor MMI without compromising video quality. USB based Key Board & Mouse shall be provided for all the MMIs.

For both types of MMIs (Single Monitor or Dual Monitor), two nos. of Ethernet/Fibre cables should be laid between workstation CPU/Server and MMI locations.

Compatible 4K KVM-HDMI extenders shall be provided for quality KVM output with MMIs at distant locations.

- 1.2.9** At locations of CCTV MMIs (Keyboard, VDU & Mouse) connected thro' KVM/HDMI extenders, a metallic Base Plate with suitable mounting arrangement shall be provided for housing/mounting industrial grade Power Strips & KVM Receiving units.
- 1.2.10** KVM-HDMI Extenders for extending KVM & Joystick output from Work-stations / Servers to various CCTV MMIs shall be as per specifications mentioned in Appendix N, Chapter 4 (Appendices) of this PS.
- 1.2.11** Specifications of Workstations / MMIs & KVMs shall be as detailed in Appendix N, Chapter 4 (Appendices) of this PS
- 1.2.12** List of MMIs required for CCTV system is detailed in Appendix-G Chapter 4 (Appendices) of this PS.
- 1.2.13** Failure of any one CCTV Monitoring Workstation (MMI) shall not affect monitoring/functioning of other MMIs.
- 1.2.14** Following CCTV equipment and functionalities is required to be provided in various surveillance zones / areas / Locations:
 - 1)** High resolution IP cameras at all locations.
 - 2)** Night Vision cameras shall be provided at all outdoor locations and following locations with low lighting. i.e. TER Gallery, Platform track end and head end, Entry/Exit, Emergency Exit, Fire Exit, Mid-Shaft, Lift Car etc.
 - 3)** CCTV workstations/MMIs shall be provided at as per details provided in Appendix-G Chapter 4 (Appendices)of this PS.

Every CCTV workstation shall have a unique user login based on the MMI location with operator level privileges and an administrator login with admin level privileges. Provision must be available in centralized video management system to customize these privileges as per requirement.
 - 4)** All features should be available simultaneously on all CCTV work stations configured in the system.
 - 5)** Every CCTV workstation shall have provision to access live and recorded videos of all cameras at Stations, Depots, RSSs, OCC & BCC etc. through an administrator VMS login having administrative level privileges. Line/Section wise VMS logins shall also be provided separately with operator and administrative level privileges.
 - 6)** Depending upon site requirement, CCTV Contractor shall provide a pedestal or mounting arrangement suitable for the 4K LED monitor(s) provided. Details of the same shall be submitted for approval / NOC of the Engineer.

It shall be Contractor's responsibility to interface with all concerned sub-contractors for proper space allocation for these monitors.
 - 7)** Where cameras with Video Motion Detection are used as part of the Intruder Detection analytics, very high-quality video images are required employing minimal compression.



- 8) End-to-end signal latency from any two points (source and destination) on the transmission network shall be suitable for establishing effective hand to eye coordination for remote operation of camera PTZ functions and shall not exceed 200 m secs under conditions of maximum network traffic.
- 9) Both, live view and recording of all cameras shall be available / done locally and/or remotely at their maximum resolution with H.264 / H.265 or better video compression (if available) with 25 and/or 30 fps as a minimum. However, the video compression provided shall comply to provisions mentioned in S.No. (3) in Annexures 5 (a) & 5 (b).
However, the recording rate shall be possible with different frame rates including 25 /30 fps with resolution of at least 4 CIF, HD, Full HD, Quad HD & 4 K (depending upon the max. resolution of camera). Playback facilities shall be available with all CCTV MMIs. The contractor shall submit a proposal for the same to the Engineer for review and approval.
- 10) CCTV surveillance system shall be designed to store minimum 7 days recording of all cameras in respective NVRs at Station, Depot, RSS, OCC & BCC with 25% spare storage capacity.
- 11) In emergencies or as required, it shall be possible to reconfigure any/all Cameras of a particular Station/Depot/RSS/Mid-Shaft/Parking/Ramp/Signal/Point Crossings/River Bridge etc. at any other dynamically selected location on system for live viewing and recording.
- 12) Anti-Virus and network security Software for the CCTV system

1.2.15 Details of the three lines where the CCTV system is required to be provided is tabulated as under:

Table 2.3: Details of Phase-IV Corridors

S.No.	Line	New / Extension	Section	Length (Km)	OCC	BCC	No. of Stations#		
							Elevated	UG	Total
1	7	Extension	Maujpur – Majlis Park	12.50	*	*	08	-	08
2	8	Extension	Janakpuri (W) – RK Ashram	29.00	*	*	15	07	22
3	10	New	Tughlakabad – Aero City	20.20	1	1	04	11	15
			Total	61.70	1	1	27	18	45

Note: – 1) * - OCC is presently available at Metro Bhavan & BCC at Vinod Nagar. The BCC at Vinod Nagar is planned to be shifted to Shastri Park. Therefore, while the BCC for the extension(s) shall have to set up at Shastri Park, the existing BCC at Vinod Nagar may also be required to be shifted to Shastri Park.

2) # - No. of stations may change (increase / decrease) in exceptional circumstances

1.2.16 All functionalities of the CCTV system(s) as stipulated above shall be **applicable** for the New Line as well Line extensions.

While new Lines of Phase-IV shall be centrally controlled from respective OCCs & BCCs (locations to be defined), extensions of existing lines (Line-7 & Line-8) shall be centrally controlled from existing locations as detailed below:

i) **Line-10 (TKD - Aerocity):**

This is a new / green field line and therefore a new CCTV system shall be provided for this line.

ii) **Line-7 extn. & Line-8 extn.:**

These lines are extension of existing Line-7 & Line-8 lines and therefore the CCTV systems for these extension lines shall preferably be integrated with the existing CCTV



system, wherein the existing servers, Video walls, MMIs, NMS etc. (at OCC, BCC & Station level) shall be suitably augmented to provide all functionalities, for both the existing Lines as well as extensions, without any degradation.

iii) Security Control Room

Security control rooms are presently available in Metro Bhavan, Vinod Nagar Depot & IT Park

1.2.17 Any one of the following solution (s) can be adopted:

- 1) **a)** Stand-alone integrated system for all the three priority corridors of Phase-4 mentioned above viz. Line-10 (TKD – Aero-City), Line-7 extn. (Maujpur - Majlis Park) & Line-8 extn. (Janak Puri - R.K. Ashram). The bidder shall have to provide integrated hardware (servers etc.), NMS & MMIs etc. (both at OCC & Station level) for all the three (3) Phase-4 priority corridors so as to provide all functionalities including control, management and other common functionalities as per extant provisions in these specifications.

The system provided for Phase-IV shall be integrated with the existing system available for Phase-III (Line-7 & Line-8) such that the MMIs available/provided for Phase-III in Central Locations (OCC , BCC & Security Control) shall also function for Phase-IV application as well.

or

- b)** Augmentation of the existing system provided for Line-7 & Line-8 in Phase-III including control , management & other common functionalities such that the upgraded system also seamlessly functions for the three (3) priority Phase-IV corridors along with the existing Line-7 & Line-8 corridors.

The existing NMSs & MMIs provided for Phase-III (Line-7 & Line-8) shall also be suitably augmented/upgraded to function for the three (3) priority Phase-IV corridors (Line-7 extn., Line-8 extn. & Line-10) without any degradation.

- 2) The bidders shall consider only one of the above solutions.
- 3) The hardware (servers) provided in both the above solutions shall be configured in high availability / redundant mode in clustered servers and Virtual Machine Environment for smooth migration of running software(s) / application(s) between clustered servers of active central system.
- 4) Details of CCTV Workstations / MMIs / Control Panels proposed to be located at all the above corridors under both the solutions is detailed at Appendix-G of Chapter-4 of PS.

1.2.18 Additional Corridors:

- 1) Four (4) additional Corridors as per tentative details tabulated below are proposed to be implemented in near future:

Table 2.4: Details of Phase-IV Corridors (additional)

S.No.	Line	New / Extension	Section	Length (Km)	OCC	BCC	No. of Stns/Depot			
							ELV	UG	Depot	Total
1		New (Metrolite)	Rithala – Bawana - Narela (Metro Lite)	22.92	MB	SHPK	19	-	1	20
2	10	Extension	Lajpat Nagar – Saket -G Block	8.39	MB	SHPK	8	-	-	8
3	5	Extension	Inderlok- Indraparatha	12.38	MB	SHPK	1	9	-	10
4	-	New (Metrolite)	Dabri Village - Bamnoli Village	10.18	MB	SHPK	10	-	-	10
			Total	45.69			38	9	1	48

These corridors are planned to be integrated with the CCTV System(s) being implemented for the three (3) priority corridors as detailed above for the three (3) priority corridors of Phase-4 project.



- 2) Accordingly, equipment for control , management & other common functionalities , both at OCC & BCC, planned for the three (3) priority corridors of Phase-4 shall be so sized & configured such that they are able to cater to requirements of the above 4 (four) additional corridors, without any additional financial implications as detailed in Para 6.2.5(a) of Chapter-1 – General Requirements of this PS.
 - 3) Provision of additional equipment , other than for control , management & other common functionalities , including Servers, Workstations, Switches, Routers etc., specifically required for functioning of the CCTV system at OCC , BCC , Stations , Depots & any other location(s) pertaining to these four(4) additional corridors , shall be processed separately, as and when required.
 - 4) The contractor shall submit details of the solution proposed to be adopted to the Engineer for review and approval.
- 1.2.19** New Videowalls being provided for Phase-4 in addition to requirements of Line-7 extn , Line-8 extn. & Line-10 shall also cater to requirements of the proposed additional corridors of Phase-4.
- 1.2.20** Centralized locations (OCC, BCC & others) shall be located in Delhi/NCR.

2. SCOPE OF THE WORKS

2.1 GENERAL

- 1) The Contractor shall design, supply, install, test and commission all equipment (hardware and software), cables, materials and interfaces required to complete the works for the CCTV system as described herein
- 2) In addition to requirements specified in Chapter-1 (General Requirements) of this Particular Specification, scope of works for the CCTV system shall include supply & services as specified below.

2.2 SCOPE OF SUPPLY

The scope of supply for the IP based CCTV system shall include, but not be limited to, the following:

- 1) CCTV Control Equipment at OCCs, Stations. Depots, RSS and any other identified locations during execution of contract.
- 2) Following IP based cameras with all accessories including vari-focal lens, IR Illuminator, Housing and mount etc.:
 - i) Fixed Box Camera (Quad HD or better resolution)
 - ii) Fixed Box Camera (4K UHD resolution).
 - iii) Fixed Dome IR Camera (Quad HD or better resolution).
 - iv) PTZ Dome IR Camera with all accessories (Quad HD or better resolution).
 - v) Corner Lift Camera with all accessories (to be within scope of Lift contractor) **except the quantities specifically included in BoQ.**
 - vi) Bullet Camera with all accessories (Quad HD or better resolution)
- 3) CCTV workstations with 4K LED Monitor(s), USB Key-Board, USB mouse and USB joystick for PTZ functionality.
- 4) Full HD laser based DLP video walls in Centralized Security Room at BCC & IT Park or any location decided during execution as per specifications at Annexure 6.
- 5) Server Based Network Video Recorders for Stations, Depots, RSS, OCC & BCC.
- 6) CCTV Management Servers with colour laser printer at the OCC & BCC.



- 7) Alarm & Report Management system at OCC & BCC.
- 8) All type of cables as per Appendix D of PS Chapter-4 (Appendices) of this PS.
- 9) Supports, Mounting brackets (Primary and Secondary), installation material and accessories for cameras, monitors, video-walls etc.
- 10) Equipment racks, Cabinets, Junction Boxes and cubicles.
- 11) All power supplies, cabling and earthing accessories including MCBs & Surge protection devices.
- 12) Extension of Main Earth to CCTV Racks, Equipment etc. from Main Earth Terminal (MET) available in TER & Sub-MET available in Concourse, Platforms & other locations
- 13) False floor, Base Frame, Under False floor trays/risers etc. in the designated TERs as per list in Appendix-J & Appendix-K of PS Chapter-4 (Appendices)of this PS.
- 14) Laptops pre-loaded with CCTV system software as per details provided in Annexure 2 & specifications detailed in Appendix-N, Chapter-4 (Appendices)of this PS.
- 15) Contract Spares shall be supplied as per details specified in Annexure 1 and Chapter-1 (General Requirements) of this PS.
- 16) Special Tools and Test Equipment shall be supplied as per details provided in Annexure 2 and Chapter-1 (General Requirements) of this PS.
- 17) All Soft-wares and licences (perpetual, there should be no need of renewal) for end to end IP based Video surveillance system.
- 18) All software and firmware as supplied shall be with license given to DMRC for lifetime and any upgrades within the currency of contract shall be free of cost.
- 19) Additional Licences for 25% expansion capacity of cameras, NVRs, workstations, Analytics & joystick etc.
- 20) Anti-Virus and network security Software for the CCTV system
- 21) Any other equipment / materials / hardware / software(s) required for satisfactory completion of CCTV contract.

2.3 SCOPE OF SERVICES

- 1) Design, manufacture, delivery, system assurance, installation, testing and commissioning of the CCTV System as detailed in this Chapter-2 (Technical Requirements) including Chapter-1 (General Requirements) of this PS.
- 2) Additional requirements required for Interchange stations, RSS, PSBs, Ramps, Parking, FoB /Passage, Mid-shaft, Point crossing and River bridges etc. as specified in Appendix-O, Chapter-4 (Appendices)
- 3) **Interface / coordination with other Project Contractors**
 - i) The CCTV contractor shall interface with various Project Contractors, as detailed /specified in various Appendices (A1-A20), Chapter-4 (Interface – Role & Responsibilities) of PS and Clause 6.2.1 of this Chapter.
 - ii) Important interfaces are inter-alia detailed below :
 - a) With Signal Project Contractors for receiving input from ESPs located at Platforms and Station Control Rooms.



- b) With E&M Contractors for receiving input from all Emergency Doors (in stations & mid-shafts) for monitoring opening of these doors.
 - c) With Lift Project Contractors for provisioning and commissioning of corner Lift camera inside Lift car(s)
 - d) With Lift Project Contractors for receiving input from Help Points in Lifts.
 - e) With Telephone System Contractor for receiving input from Help Points on Stations.
 - f) All the above incidents shall be recorded as events (1 min. before & 5 mins after the event) in the CCTV system.
- iii) CCTV (CS16) Contractor shall interface with concerned CTFRS contractor and provide all relevant system data through API for integration & successful commissioning of CCTV component of work in the CTFRS.
 - iv) In case CCTV contractor(s) fails to coordinate/interface with other contractors, then the CCTV contractor(s) shall be responsible to complete all work required as part of this contract with no financial implication to DMRC
- 4) The Contractor shall provide system training(s) to DMRC staff and also provide desired DLP support after successful commissioning of CCTV work in section or part of section.

2.4 SCOPE OF SERVICES EXCLUDED IN THIS CONTRACT.

- 1) Provision of Un-interruptible AC Power Supply to meet with the power supply requirement of the CCTV Contract for all locations including Stations, Depots, OCC & BCC is not included in scope of this contract (DS16).
- 2) AC Power Supply for All Telecom sub-systems shall be provided by PIDS-PAS Contractor (DS15) at Telecomm. AC Distribution Board (ACDB) in TER/CER. The interface will be through MCB/MCCB in the Telecomm. ACDB provided by DS15 Contractor.

CCTV (DS16) Contractor shall lay redundant Cables from Telecomm. ACDB to Equipment Racks for powering equipment to be supplied and commissioned under their Contract.
- 3) Earthing arrangement in the TER/CER shall be provided by E&M contractor at an MET, as defined in the Interface document.
- 4) The MET in the TER shall be extended to a sub-MET in Concourse & Platforms by PIDS/PAS Contractor (DS15). All equipment/rack in the TER and Platforms & Concourse shall be earthed using the MET & sub-MET respectively.

Details are specified in Appendix-A4 & Appendix-A5 of Chapter-3 (Interfaces - Roles & Responsibilities) of this PS.



3 PERFORMANCE REQUIREMENTS

3.1 GENERAL

3.1.1 Technical system performance requirements for the CCTV system are specified in this Chapter-2 (Technical Requirements) as also Chapter-1 (General Requirements) of this Particular Specification. The system shall also comply to additional performance parameters required for satisfactory performance / working of the CCTV system as per these specifications on 24x7 basis.

3.2 RELIABILITY

- 1) The inability to perform any required function, the occurrence of unexpected action or the degradation of performance below the specifications shall be considered as a failure.
- 2) MTBF shall be the average operating time accumulated by the total population of identical items between failures. MTBF shall be sustainable throughout the DLP and substantiated by actual performance over the same. The data sheets from the OEM of the cameras, monitors and other equipment for the indoor and outdoor shall be specifically conforming to the same, including temperature and humidity requirements.
- 3) The Contractor shall ensure that the CCTV system equipment supplied under the Contract shall comply with the reliability figures herein:

Table 2.5: MTBF Figures

CCTV System Equipment	MTBF (Hours) per unit
Station and central equipment	> 50,000
IP Cameras	> 60,000
Video recording equipment	> 50,000
Digital CCTV Keyboard	>50,000

3.3 AVAILABILITY

- 1) Availability requirements as stated in this PS are to be complied with. System design shall be Fault tolerant with adequate protections against failure in order to achieve the required system availability.

Protections shall include, but not be limited to path diversity, redundancy and duplication so as to ensure reliability of critical equipment, component and circuits

- 2) The CCTV system shall have a system availability of better than 99.95%. MTBF of each equipment shall be substantiated by the previous experience or if calculated by a confidence factor, all supporting calculations, assumptions and specifications to arrive at the MTBF figures and system availability shall be submitted.

3.4 MAINTAINABILITY

- 1) The Mean Time To Restore (MTTR) of the CCTV system to full normal operation following a failure shall be less than four hours (excluding travel time).
- 2) Notwithstanding the above MTTR, it shall be ensured that availability requirements of the CCTV system are met.
- 3) The service life of the CCTV equipment except server(s) / work-station(s) shall not be less than 15 years. The service life of all types of cables shall not be less than 25 years. The service life of Server(s) / Work-Station(s) including associated operating software(s) shall not be less than 10 years. The Service life shall be counted from the commencement date of Defects Liability Period.



3.5 SYSTEM SAFETY

- 1) All metallic enclosures shall be provided with an earth terminal. Earthing of all equipment shall be in accordance with the overall guidelines for earthing laid down in CHAPTER-1 (General Requirements) and Appendix-I of Chapter-4 (Appendices) of this PS of this PS.
- 2) External surge protection devices should be used at the input of all vulnerable equipment for effective transient protection as specified in Appendix-I of Chapter-4 (Appendices) of this PS.

3.6 SYSTEM SPECIFIC PERFORMANCE

- 1) Response time for appearing the camera view on MMI & Video wall shall not exceed 50 m secs.
- 2) CCTV system shall be designed such that, minimum 7 days recording of each camera is always available even in degraded mode.



4 FUNCTIONAL REQUIREMENTS

4.1 GENERAL

- 1) The CCTV system shall have facilities of real time surveillance & monitoring with high resolution colour video streams of all cameras.
- 2) System should provide inter-operability of all hardware (Workstations, servers/ storage, monitors, cameras) provided in the system.
- 3) System expansion should be possible through commercially available off-the-shelf hardware.
- 4) The CCTV System shall have high resolution IP based (Fixed Box (Quad HD & 4K UHD), Fixed Dome, PTZ Dome, Bullet Camera (Quad HD) & Corner Lift) colour cameras with all required accessories.

CCTV contractor shall design location of all cameras so as to comply with the coverage requirements. The CCTV Coverage is to be provided by provision of Fixed Box, Fixed Dome, Bullet Cameras and Corner lift cameras only. Coverage by PTZ cameras shall not be considered for provision of CCTV coverage.

CCTV camera coverage plots for all the locations shall be submitted as part of the detailed design to the Employer's Representative for review and approval.

- 5) Requirement of verification, testing and commissioning are given in Chapter-1 of this PS.

The test procedures shall include procedures for measurement of picture quality, visibility distance and visibility angle for MMI & Video Wall etc.

In addition, the contractor as part of PAT procedure shall conduct continuous CCTV coverage tests following the pre-defined spots for each camera at every Station / Depot / OCC / Location and submit the result for approval of the Engineer.

- 6) Tentative typical drawings of DMRC Phase-IV Stations / locations are provided in Chapter-5 of this PS.
- 7) System shall use video signals and audio signals from various types of indoor/outdoor IP cameras installed at different locations, process them for viewing on CCTV workstations simultaneously at Central Control Rooms (OCCs, BCC & IT Park) and local control rooms at every station, Depot & RSS. Use of the Audio Signal shall be configurable , as per requirement.
- 8) Joystick shall be used to operate PTZ cameras for Pan, Tilt & Zoom. Few Control functions of MMI such as selection of cameras, toggle etc. shall also be available in Joystick.

The latest saved configuration of cameras, network video recorders, workstations, joystick etc. shall always be available in centralized video management servers and this shall be accessed/modified and saved from OCCs or / and any other pre-defined locations.

All cameras, network video recorders, workstations, joysticks etc. shall be synchronized with latest saved configuration available in centralized video management servers.

- 9) Network Video Recording system shall provide local recording at every station / location and its mirrored recording (at a pre-defined alternate station / location) for all stations / locations as detailed in these specifications.
- 10) Video signals and audio signals from various cameras provided in Depot / Station / OCC / BCC / RSS & other locations shall be made available to the following:



- i) Respective NVRs (Primary and /or Secondary)
 - ii) All Associated workstations/MMIs
 - iii) All Video walls provided in the network.
 - iv) Video signals and audio signals from all cameras provided at all locations in the network shall be seamlessly available for control & monitoring from / at all Workstation/MMIs and Video walls provided in the network. Use of the Audio Signal shall be configurable , as per requirement.
 - v) Any other location to be decided by the Employer's representative during detailed design review.
- 11)** Both in Depot & Stations there are many building/locations which are geographically scattered i.e. DCC, workshop, Admin building, IBL, SBL, ETU building, Canteen, DCOS, Security Time office, security gate, watch towers, periphery of depot, Test track, Depot ramp in Depot & Points & Crossings, Mid-tunnel shaft, Ramp , River Bridge , Parking , FoBs, Interchange Areas etc. on Main Line.

These buildings/locations are far from the Telecommunication Equipment Rooms (TER) where CCTV system shall be installed. Installation of CCTV cameras in these buildings/locations & their connectivity (optical fibre/Ethernet (as required)) to the nearest L2 switch shall be in scope of CCTV contractor.

- 12)** Provision of Layer-2 switches (Temperature hardened / Industry grade) and their connectivity to the network shall be in scope of FOTS (DS11) Contractor. Both FOTS (DS11) & CCTV (DS16) Contractors shall coordinate for finalising location of Layer-2 switches & its connectivity (OFC / Electrical) to the IP-MPLS network. Provision/installation of all CCTV camera/equipment and their connectivity to the nearest L2 switch shall be responsibility of CCTV (DS16) Contractor.
- 13)** CCTV contractor (DS16) shall calculate type/nos. of ports as per their design and submit the same to FOTS (DS11) contractor for nomination of PoE/PoE+ ports to the associated L2 switch.

Ethernet output from the IP cameras shall be directly connected to the field switch through data cable with suitable protection devices (in vicinity of High Voltage Lines). Provision /installation of all CCTV camera/equipment and their connectivity to the nearest L2 switch shall be responsibility of CCTV (DS16) Contractor.

If the power (PoE/PoE+) available on the field switch ports is not sufficient to drive/powering the PTZ functionalities, a separate power cable shall be laid by CCTV (DS16) Contractor.

- 14)** Some of the cameras at specific locations in Depot, RSS, Signal point crossings, Ramp, River-Bridges, Parking etc. are required to be installed outdoor i.e. outside the buildings with no covering shed, are identified as theft prone.

At all such locations, a proper weather proof mounting & housing arrangement complying to IP- 66 or better provisions shall be provided for housing complete assembly of these cameras with combination of vari-focal lens & other accessories. The camera housing shall preferably be of the same make as the camera.

Suitable weatherproof Junction Boxes complying to IP-66 or better shall also be provided for housing all associated termination equipment i.e. SPD, I/O Box, LIU etc. at all out-door location. Make of Junction Box shall preferably be of same make as the camera.

The CCTV (DS16) contractor shall submit details of Housing and mounting arrangement proposed to be supplied for approval of the Engineer.



- 15) All outdoor CCTV equipment shall be earthed properly along with poles for Cameras at RSS, SPC, Ramp, Parking, River-Bridge, Depot, other outdoor locations etc.

All ESPs (Emergency Stop Plunger) provided by Signalling & TC contractor, at platform(s) & Station Control Room(s) (SCR), shall be interfaced to a dedicated CCTV camera for identifying the person / conditions for operation of the ESP.

This dedicated CCTV camera shall provide full coverage of the associated ESP. In event of operation of the ESP, this camera shall receive an input from the S & TC system.

On receiving this alarm input, a pop-up window with live view of the dedicated CCTV camera shall pop up on respective CCTV MMIs at station, OCC & BCC simultaneously. The CCTV system shall generate a video of 1 min. before the event & 5 min. after the event and shall be available in the NVR server for access. Responsibilities of CCTV and Signal & TC contractor are detailed in Appendix-A3 of Chapter 3 (Interfaces) of this PS.

The CCTV and Signalling & Telephone contractor(s) shall interface with each other so as to provide/implement this functionality.

- 16) A dedicated Corner Lift camera shall be provided inside every Lift car of station. The Lift Contractor shall be responsible to supply and install this camera and also provide data & power connectivity for this camera inside the Lift. Role and Responsibilities of DS16 and Lift Contractor are specified in Appendix-A2 of Chapter 3 (Interfaces) of this PS.

- 17) The CCTV system shall interface with the Help Panel inside the Lift car, Help Phones on the Platform and Emergency Doors provided at the Station & Mid shafts. All Help Panel inside the Lift, Help phones on the Platform & Emergency Doors shall be interfaced with the associated CCTV Camera (Lift, Platform, Concourse & Mid Shafts) thro' an alarm input, for identifying the person / conditions of Help-Point & Emergency Door operation (Opening).

On receiving the alarm input, a pop-up window with live view of the associated CCTV camera shall pop up on respective CCTV MMIs at station, OCC & BCC simultaneously. The CCTV system shall generate a video of 1 min. before the event & 5 min. after the event and shall be available in the NVR server for access.

Role and Responsibilities of CCTV (DS16) and Lift & E&M (for Emergency Doors) Contractor(s) are detailed in Appendix-A2 of Chapter-3 (Interfaces) of this PS.

Role and Responsibilities of CCTV (DS16) and Telephone Contractor are detailed in Appendix-A19 of Chapter-3 (Interfaces) of this PS.

- 18) **CCTV System (Backbone & Access Network):**

The FOTS contractor (DS11) shall provide an integrated IP-MPLS network including Layer 2 & Layer-3 network required for networking of all sub-systems (Telecom & non-Telecomm.) for the Phase-4 Metro Network. Network requirements for the CCTV system shall also be met from this integrated IP-MPLS Network including Layer-2 (PoE /PoE+/PoE++) & Layer-3 switch network provided by the FOTS contractor.

The CCTV system locations requiring IP-MPS network connectivity shall consist of all Phase-IV Stations, Depots & RSSs including Centralized locations (OCCs, BCCs, IT park etc.). Additional Layer 2 CCTV network if required at centralized locations, shall be provided by FOTS (DS11) Contractor.



While all network requirements (Layer-2 & Layer-3) for the CCTV system shall be catered by the IP-MPS network provided by FOTS (DS11) contractor, any other hardware i.e. Junction Box for SPDs, Junction Box for PTZ and IR cameras, converters etc. required by CCTV system shall be provided by CCTV contractor (DS16).

The CCTV Contractor shall interface with the FOTS Contractor for ensuring provision of sufficient PoE Ports on the Layer-2 switches and bandwidth required for smooth functioning of the CCTV system.

The CCTV (DS16) Contractor shall submit calculations for bandwidth (max.) required to be provisioned on the IP-MPLS network at stations (both elevated & underground), OCC, BCC, RSS & other locations etc. to the FOTS (DS11) contractor. The CCTV (DS16) contractor shall also submit the detailed design calculations to the Engineer for review and approval.

Location of all field switches shall be finalised by FOTS (DS11) Contractor in consultation with other telecom. Sub-system contractors and with approval of the Engineer.

Tentative Network proposed for the CCTV system at different locations is enclosed at Annexure 3.

- 19) List of Stations, Depot, RSS & other locations to be provided with Video Surveillance System in DMRC Phase-IV is given in Appendix-C of Chapter-4 (Appendices) of this PS.

4.2 CCTV COVERAGE

- 1) The station CCTV surveillance system shall provide 100% coverage of the following specific areas at all stations as a minimum:
- i) All Train doors/Platform Screen Doors (6/8 Coaches) at the Platform
 - ii) Platform operational area and Platform ends/Tunnel ends
 - iii) Complete length of all Escalators and Stairs
 - iv) Complete Concourse area
 - v) All Lift entries at Platform, Concourse and Ground level (if inside the gate/shutter)
 - vi) Inside of each Lift car
 - vii) Platform ESP
 - viii) Help phone at station platforms
 - ix) ESPs at Station Control room
 - x) Fireman staircase exit
 - xi) TER gallery
 - xii) Signal Point Crossings
 - xiii) Ramp
 - xiv) Mid-shaft
 - xv) River-bridge
 - xvi) All Station entrances and exits (including Emergency, Fire exit)
 - xvii) All Automatic Fare Collection (AFC) gates both Entry & Exit of every gate
 - xviii) Exterior of Ticket Booking Offices



- xix) Exterior of fare adjustment Office
- xx) Subways, Foot Over Bridge, Cross Passage areas
- xxi) Corridors & Interchange area
- xxii) DG room in Underground station
- xxiii) OCC & BCC
- xxiv) Any other location / area defined during detailed design stage
- 2) The Depot CCTV surveillance system, shall as a min., provide maximum coverage to the extent possible at following specific locations, in the Depot:
- i) All Entrance /Exit gates and Outside area of Security Time office
- ii) DCC, Workshop, Admin Building, IBL, SBL, ETU Building, Canteen, DCOS etc.
- iii) TER gallery.
- iv) Watch towers and Periphery / wall of Depot.
- v) Test track and Depot Ramp
- 3) Quantity & Types of different cameras (typical) proposed to be provided, at various locations / areas is tabulated below:

Table 2.6: Quantity & Type of Cameras at Various Locations

Location	FB Camera (Quad HD) (nos.)	Bullet Camera (Quad HD) (nos.)	FBIR Camera with Manual Focus & Zoom Control (4K UHD) (nos.)	FBIR Camera with Remote Focus & Zoom Control (4K UHD) (nos.)	FDIR Camera (Quad HD) (nos.)	Lift Camera* (Full HD) (nos.)	PTZ Camera (Quad HD) (nos.)	Total (nos.)
Elevated station	35	6	2	2	7	4	2	58
Underground Station	41	6	2	4	9	4	3	69
Depot	8	2	6	8	0	0	4	28
OCC-BCC	10	5	10	5	30	3	6	69

In addition to the above requirements at stations, CCTV cameras (typical) as detailed below shall also be provided at following locations:

Table 2.7: Quantity & Type of Cameras at Additional Locations

Location	FB Camera (Quad HD) (nos.)	Bullet Camera (Quad HD) (nos.)	FBIR Camera with Manual Focus & Zoom Control (4K UHD) (nos.)	FBIR Camera with Remote Focus & Zoom Control (4K UHD) (nos.)	FDIR Camera (Quad HD) (nos.)	Lift Camera* (Full HD) (nos.)	PTZ Camera (Quad HD) (nos.)	Total (nos.)
RSS	-	-	-	4	4	-	-	8
Ramp	-	-	-	2	-	-	-	2
Mid-Shaft	-	-	-	-	4	-	-	4
Point Crossing/ Machine	-	-	1	-	-	-	-	1
River Bridge	-	-	-	4	-	-	-	4
Parking	-	-	-	2	-	-	-	2

Note: - * Lift Camera shall be provided by Lift Contractor as per specs. communicated by Telecomm. Interface between Lift & CCTV contractors is detailed in Appendix-A2, Chapter-3 (Interfaces). **(except the quantities specifically included in BoQ)**



- Wherever applicable, DS16 shall supply the pole required for mounting the Camera
 - Parking cameras shall be installed at the stations wherever Parking is available.
- 4) From the above tabulation the CCTV Surveillance System shall have a total of 58 nos., 69 nos. & 28 nos. of different types of cameras at Elevated, Underground stations and Depots respectively.

Tentative location(s) of the above cameras is given at Annexure 4 of this document.

- 5) The CCTV Coverage of the above areas shall be calculated at identification level not at detection or observation level. For better clarification, monitoring levels can be defined in term of highest pixels density (from lower to higher order) in the form of DRI (D - Detection, R - Recognition and I - Identification). The pixel density (pixels / meter) for identification should be minimum as follows:
- i) for Quad HD Box camera the pixel density shall be 180 pixels/meter at distance of up to 20 meters at horizontal angle of 30°
 - ii) for 4K UHD Box camera the pixel density shall be 180 pixels/meter at distance of up to 40 meters at horizontal angle of 30°.
 - iii) for Quad HD Dome camera the pixel density shall be 180 pixels/meter at distance of up to 08 meters at horizontal angle of 70°.

Accordingly, the CCTV Contractor shall propose the combination of cameras along with lenses to obtain the minimum requirement as specified in the PS or better than the requirement mentioned in this specification. In no case, the quality (pixel density) of picture can be degraded when calculating the CCTV coverage.

- 6) The display of full screen mode of a 1.8 m tall person standing upright, within the CCTV camera coverage area, on any monitor shall not be less than one tenth of screen for the fixed cameras at the shortest focal length.

The contractor shall conduct a coverage study and develop a report including exact location of each camera for the CCTV surveillance system for all Station(s) , Depot, RSS, OCC, BCC and all other area(s) and submit the same to the Engineer for review & approval

The Contractor is advised to study the site before finalising the exact location of each camera and indicate the same in the coverage drawing.

Location of each camera planned for installation shall also be decided as per site requirement during execution.

- 7) Where-ever cameras in addition to the above provision are required to achieve the coverage, the same shall be proposed by DS16 in his Design/Application Engineering with reference to the requirement in these specifications for consideration of the Engineer.

4.3 NETWORK VIDEO RECORDING SYSTEM

- 1) Network Video recording system shall comprise of **one** COTS server at every station / location for Primary & Mirrored recording of all cameras of Local/Primary & Secondary stations/locations respectively.
- 2) Viewing and recording (Primary and Mirror) of all types of cameras i.e. Full HD, Quad HD & 4K UHD at any location shall be in accordance with resolution of the 1st & 2nd stream as specified in Annexure(s) 5 (a) & 5 (b) with frame rate at 25 / 30 fps.

Recording System shall have the capability to record audio signals (configured as per requirement) , received from local cameras at station / Depot / RSS / OCC / BCC along with the video recording (in same time-line) so that during playback of any camera from the workstation, video recording shall be played along with real time audio recording.



- 3) The Full resolution i.e. Full HD, Quad HD & 4 K UHD respectively at 25 / 30 FPS for each type of camera both for the Primary & Secondary location(s) shall determine the capacity of the storage device at every location.

The storage capacity shall be calculated keeping in view the spare capacity of 25% of the installed capacity.

- 4) CCTV contractor (DS 16) shall coordinate / interface with the FOTS (DS11) ensure adequate bandwidth, ports, channel, forwarding rate etc requirements in the FOTS.
- 5) Working of the Primary & Mirrored recording mechanism of the Network Video recording system shall be as under:

i) **Primary & Mirrored Recording:** Every station / location (Depot, RSS, OCC and BCC) shall have one recording Server. This recording server shall be so configured/sized such that it acts both as a Primary & Mirror recording system for the Primary & Secondary locations respectively.

a) The recording server shall record all cameras of the Primary station / location and also mirror record all cameras of adjacent station / location.

ii) Failure of any recording server (either Primary or Adjacent for Mirror recording) shall not have any effect on availability of recording of any CCTV camera, as all the cameras are being simultaneously recorded, both at Primary and adjacent location(s).

iii) Every **Network** recording server shall have two equal size Inbuilt Storage Arrays (Primary and Mirrored) in RAID-5 or better Configuration.

iv) Minimum storage space for each RAID group (Primary or Secondary) shall be 48 TB. Each Hard-disk of the RAID group shall be of min. 16 TB capacity.

v) **Primary recording:** All cameras of a particular Station, Depot, RSS, OCC and BCC shall be recorded locally in Primary RAID group of the Network Recording server.

vi) **Mirrored Recording:** All cameras of a particular Station, Depot, RSS, OCC and BCC shall also be recording remotely in a secondary RAID group of Network Recording Server at adjacent station/location (As decided by Engineer's representative)

vii) **SD** cards provided on all cameras shall be configured to :

a) either record continuously or record on isolation of the Camera (failure of connectivity) from the NVR or failure of the recording server

b) record with the same resolution as the recording server.

c) record on FIFO basis.

On recovery of any failed recording server or connectivity of the camera, the recording available on the SD card of CCTV cameras shall be transferred to the Recording server such that the break in the recording of the CCTV cameras caused due to the failure is filled up and continuous recording of all the cameras is available on the recording server.

viii) The Video Management System shall manage failure of the recording system such that all such failures are transparent to the user w.r.t to access / retrieving the recording(s) of the CCTV cameras i.e. the users shall continue to retrieve recordings of CCTV cameras of the failed servers as if no failure has occurred.



- a) All recordings shall have associated time and date stamped information superimposed onto the video image.
- b) The Network video recording system shall be capable of operation for 24 hours per day, 365 days per year.
- c) In the event of recording operation being interrupted, for any reason i.e. power failure etc., it shall automatically resume recording, on rectification of the fault i.e. resumption of power supply etc., of all the cameras it was recording prior to the interruption.
- d) In the event of network disruption / disconnection with the central system, local recording and local live viewing/retrieval thro' the Workstations/MMIs provided at the Stations/Depot/OCC/BCC/ other locations shall continue & not be affected.
- e) Video recording shall be tamper proof such that even the administrator shall not be able to delete any video clip from any camera. Any attempt to delete or edit of video clips shall generate an alarm in the system which can be sent to the administrator.
- f) The contractor shall submit a detailed proposal for the Primary & Mirrored recording system for review /approval of the Engineer.

4.4 VIDEO MANAGEMENT SERVER

4.4.1 System Features of VMS

- 1) A management server shall control the video management system so that the system administrator has full control of all system components locally, or from a remote location.
- 2) The management server shall contain the Event, Log, Data collection, etc services, which by default shall be installed on the same server as the management server software; however, if not feasible, it shall be installed on separate servers.
- 3) The management server shall be able to handle client login, system configurations, performance counters and logging.
- 4) A management client shall be available for remote administration of recording servers, devices, security, rules, logging etc.
- 5) The management server shall be able to store the system's configuration for all clients, servers and IP cameras in database, either on the management server computer, or on a database server in the network.
- 6) The management server shall be able to manage all user authentication and user rights.
- 7) The software shall allow for installation of Anti-Virus and network security Software
- 8) The management server shall be installed on multiple servers clustered together. In case a server in the cluster fails, another server in the cluster shall automatically & seamlessly take over the failed server's job running the management server.
- 9) The system shall act as an SNMP agent which can generate an SNMP trap as a result of rule activation in addition to other existing rule actions.
- 10) The system shall support interoperability with IP camera standards including, at a minimum, the Open Network Video Interface Forum (ONVIF).



- 11) The system shall include a universal driver that shall support any generic network camera. The driver must be able to handle standard video streaming formats including MJPEG, MPEG4, H.264 & H.265.
- 12) Suitable indication to the OCC operator shall be given if one video recording server fails/ shut down.
- 13) The administrator through the relevant software shall be able to do software auditing which displays the software versions running on the CCTV equipment.
- 14) The system shall be capable to generate reports of stored device configuration, alarms and alarm logs. The log shall be able to be archived, printed and displayed using a device filter, a device group filter and/or a time window.
- 15) The system shall support search of recorded video for motion in user-specified areas of a camera image. This intelligent post-recording motion search will work for cameras connected.
- 16) It shall be possible to backup and restore system configuration in order to quickly restore the configuration of the video management system.
Two types of backup of system configuration shall be possible:
 - i) **Scheduled backup / Automatic Backup**
 - ii) **Manual backup:** System logs shall not be backed up or restored when performing manual backup or restore.
- 17) Following features with a facility for viewing shall be monitored on the VMS client(s):
 - i) Camera information (Name, Type and IP Address)
 - ii) Camera status (Connected or disconnected)
 - iii) Connectivity status between camera and associated NVR (Connected or disconnected)
 - iv) Recording on Primary storage (Available or not)
 - v) Recording on mirror storage at adjacent location (Available or not)
 - vi) Identification of storage during playback (Primary or mirror)
 - vii) Events triggered on camera i.e. ESP alarm, Emergency door open etc.

4.4.2 Alarm management features of VMS Client.

- 1) Alarms defined in the system shall be based on user groups. Specific alarm shall go to only selected users. Alarms, health status & displays generated by the CCTV system shall be shown locally as well as at remote location in OCC, Depots & CERs.
- 2) The system shall allow alarm escalation, alarm priority etc. The escalation & priority of alarms shall be configurable.
- 3) The alarm management shall allow operators to have a centralized point from which it shall be possible to keep track of incoming alarms.
- 4) The camera associated with alarm shall be displayed as a separate video window.



- 5) The system shall allow the Camera Server to capture video prior to the alarm /event, as well as after the alarm/event and shall be selectable from a list of values ranging between 0-60 seconds for prior-event and 1-5 minute for post event
- 6) An alarm/event preview window shall display recorded video from a selected alarm or event if these have videos associated with them. The alarm preview video shall consist of 1 min. before the alarm/event and 5 min. after the alarm.

If there are more than one camera associated with an alarm or if more than one alarm is selected, the preview shall show video from all associated cameras (up to 9 cameras).

The Alarm Management system shall also have facility to filter the desired incident based on Time & Date.
- 7) The alarm management shall be able to set any monitor or groups of monitors to automatically display cameras in response to alarm inputs.
- 8) The alarm management shall be able to reset automatically or manually alarmed video.
- 9) The alarm list shall include a number of columns that shall describe different details of the alarm/event, for example the time of the alarm, the alarm priority level, alarm ID and type of alarm
- 10) It shall be possible to filter the columns in the alarm list.
- 11) The System shall provide an alarm reaction time of less than 1 second when sufficient network bandwidth is available
- 12) It shall be possible to double-click an alarm to open an alarm window. The window shall show a preview of the alarm incident and live video.
- 13) It shall be possible to acknowledge that an alarm has been received and will be handled. It shall be possible to acknowledge multiple alarms simultaneously.
- 14) It shall be possible to view alarm reports, representing predefined reports on category, state, priority, reasons for closing the alarm, site, and response time.
- 15) It shall be possible to enable a sound notification which shall alert operators of new alarms. It shall be possible to use a default sound file or a custom .wav file which can be uploaded to and tested in the management client. It shall be possible to remove the sound notification if it is no longer needed.
- 16) An alarm sound settings option shall make it possible to configure the sounds to be available. By default, the video management system shall use Windows default sounds.
- 17) An alarm data setting option as indicated below shall be available, as a min., and make it possible to define and customize alarm priorities, states and categories:
 - i) Default alarm priorities shall be available, which shall be low, medium, and high.
 - ii) Default alarm state shall be available, which shall be new, in progress, on hold, and closed.
 - iii) It shall be possible to assign sounds to alarm priorities.
- 18) Selecting alarms in the navigation pane shall open the alarm function which, based on functionality handled in the management server, shall provide central overview, control and scalability of alarms in any number of federated video management system installations throughout an organization.



4.5 VIEWING CLIENT (MINIMUM LICENSE FOR 120 CLIENT APPLICATION)

4.5.1 The viewing client shall enable operators to connect to the Video Management Server (VMS) for initial authorization. Upon authorization, the viewing client shall be able to connect to the recording server(s), for access to live and recorded videos. Once authorised, the viewing client shall run independently of the Management server(s) and shall continue to operate even if the management server(s) is/are offline. In event of failure of Management server(s)/Management server(s) going offline, the video recording system shall also continue to record /shall not be affected.

However, in the degraded mode (when the connectivity between (both) Management server(s) and the station is not available), the local as well as recorded video viewing including Video Analytics & PTZ functionality shall not be affected till the VMS client continues to be logged on to the system and preferably also when the viewing client logs out of the system and logs again under these failure conditions.

4.5.2 The Client operator shall be able to drag and drop a camera from a tree of available cameras or a camera sequence into any video tile for live viewing.

4.5.3 Viewing client application shall have provision to manage associated incidents recorded as a result of events such as ESP operation, Help Point Operation (in Lifts & at Platforms) , Emergency Door Opening etc. Application shall have facility to filter the desired incident based on date & time.

4.5.4 The viewing client shall allow the user to be able to:

- 1) view live video from cameras
- 2) play back recordings from cameras with a selection of advanced navigation controls, including an intuitive timeline browser.
- 3) switch between a number of views, each able to display videos from 1 up to 16 cameras from multiple servers at a time.

The system shall make it possible to create views based on different layouts optimized for 4:3 and 16:9 display ratios.

- 4) access views of cameras on any PC with a viewing client installed.
- 5) use multiple screens as well as floating windows for displaying different views simultaneously.
- 6) quickly replace one or more views of cameras with other cameras.
- 7) view images from several cameras in sequence in a single camera position in a designated carousel position.
- 8) control PTZ cameras.
- 9) use digital zoom on live as well as recorded video.
- 10) activate manually triggered events.
- 11) use audio notifications for attracting operators' attention to detected motion.
- 12) get a quick overview of sequences.
- 13) quickly search for motion in selected areas of a video recording.
- 14) print images
- 15) copy images for subsequent pasting into word processors, e-mail, etc.



- 16) export recordings (for example, for use as evidence) as still images (JPEG), in media player format (AVI), or native database formats.
- 17) add a digital signature to exported recordings in the database format in order to verify that the recordings have not been tampered with.
- 18) The viewing client shall allow the user to be able to mute the audio recording of any camera during playback of video recording and also increase/decrease the volume of Audio recording.

4.5.5 **MAPS**

- 1) The viewing client shall include a built-in map function which shall provide an intuitive overview of the system and shall offer integrated access to all system components.
- 2) The map function shall be able to use any of the standard graphical file formats including: DWG, JPEG, jpg, gif, png, tif, etc.
- 3) It shall be possible to use any number of layered maps with easy to use drag-and-drop and point-and-click icons in the maps representing cameras and servers.
- 4) The viewing client shall support a map function which shall support instant camera preview when moving the mouse pointer over a specific camera.
- 5) The map function shall support real-time status monitoring indication from all system components.
- 6) The map function shall support graphical at-the-glance visualization of the system status through color coding. Graphical tool illustrating health status of various equipment on a single screen in a Top Down approach such as line diagram, normal status of all equipment at a station shown in Green colour and fault status shown in Red colour. The status can be zoomed at various levels to identify specific faults to card or component level. The Contractor may propose alternate graphical scheme for review and acceptance of the Engineer.
- 7) The map function shall provide a central overview of the video management system via an alarm list containing high, medium or low prioritized alarms.
- 8) The maps shall have the ability to contain hyperlinks to create a hierarchy of interlinked maps.
- 9) The operator shall be able to drag and drop a camera from a map onto a video tile for live viewing in the same browser without using a new browser.

4.5.6 **Standalone Viewing Client/Player**

- 1) The standalone viewing client shall make it possible to view exported video.
- 2) The standalone viewing client shall run from an .exe file, and no installation of software shall be required in order to view exported sources.
- 3) It shall be possible to assign a password to a project or to devices so that only people with permission shall be able to access the project or devices. Once a password has been set to a project, the password shall not be possible to delete. It shall be possible to edit the password.
- 4) It shall be possible to verify signatures of native database format video sequences to verify that the files have not been tampered with.

4.5.7 **Mobile Viewing Client (at least 10 licenses)**

It shall be possible to access and view cameras and views on a Smartphone or a tablet (a mobile device) with all essential functionalities including Camera list per location, Live viewing, Recording Playback, etc.



4.6 NETWORK MANAGEMENT SYSTEM (ALARM & REPORT MANAGEMENT SYSTEM)

- 1) Alarm and Report management system shall be provided at OCC and BCC for monitoring status of hardware, software and 3rd party system(s) and alarm(s) of CCTV equipments i.e. Cameras, NVRs, Workstations & Central servers etc. and report generation of active failures pertaining to primary & mirror recording as also cameras, NVRs, workstations and central servers going Off-Line.

System shall automatically generate an audio/visual alarm on occurrence of an alarm.

Specifications as a min of the Alarm Management Server is indicated in Para 5.2.12.

The details of CCTV Management System/Network Management System shall be submitted, for review and approval, to the Employer's representative.

- 2) A separate application shall be developed for report & alarm management or same to be included on VMS. This application must have a user-friendly GUI with separate sub-windows for displaying active alarms of following types of failure:

- i) Offline Cameras
- ii) Cameras with no recording
- iii) NVR failure
- iv) IVA Alarms

This application shall have provision for generating/configuring user friendly MIS reports along with filtering of alarm logs by applying different types of filters i.e. date/time, station, username, camera, NVR etc.

There shall be provision to generate and print the MIS reports & filtered alarm log.

- 3) Laptop computers with preloaded CCTV system software as per details provided in Annexure 2 (Special Tools & Test equipment) and Specifications detailed in Appendix-N of Chapter-4 (Appendices) of this PS, shall be supplied as part of DS16 contract for maintenance of the CCTV system.

4.7 DLP BASED LASER VIDEO WALL (FULL HD)

4.7.1 Provision of Laser Video Walls

- 1) **Security Room (IT- Park)**

DLP based laser video wall of size 5x2x70" with three CCTV workstations (with dual monitor) shall be provided at Security room-IT park for smooth CCTV surveillance & monitoring of new lines and extensions.

- 2) **Security Room (BCC)**

DLP based laser video wall of size 5x2x70" with one CCTV workstation (with dual monitor) shall be provided at Security room of BCC (location to be decided during execution) for CCTV surveillance & monitoring of new lines and extensions.

4.7.2 Specification of Video Wall System

- 1) **Specifications of DLP based laser video wall** are given in Annexure 6.

The CCTV contractor shall submit a proposal indicating the make & model of the proposed video wall to the Engineer for review & approval. The video wall shall be procured only after receipt of no-objection from the Engineer.



2) **Video Wall Application**

- i) The application shall provide dynamic control of the layout of the video wall, and content shall easily be added by dragging and dropping cameras into view positions on the video wall.
- ii) The federated architecture shall support integration and user control of the video wall application when the video wall is installed on the same site that the users are logged into.
- iii) It shall be possible for operators to manually set video wall to presets and set a video wall monitor to show specific cameras.

4.8 VIDEO ANALYTICS

CCTV system shall be provisioned with Edge based analytics at firmware level of cameras.

Following video analytic features shall be available in system as a minimum:

- 1) Intrusion Detection
- 2) Left Object Detection
- 3) Removed Object detection
- 4) Overcrowding
- 5) Loitering
- 6) Camera Tampering

The CCTV cameras shall be so positioned / located to enable satisfactory performance / functioning of the above video analytic features. It shall be possible to consider additional conditions along with edge analytics to avoid generation of false alarms.

It shall be possible to configure generation of an event of 1 min. before and 5 min. after every incident / alarm.

4.8.1 Intrusion Detection

This analytic functionality shall be used to detect Intrusion under following scenarios:

- 1) Crossing/infringement of the PSD/Track at platform ends.
- 2) Crossing/infringement of boundaries of Depot & Ramp
- 3) Crossing / infringement of any other pre-defined boundary / location

4.8.2 Left Object Detection

This analytic functionality shall be used to detect abandoned objects in following areas, as a min:

- 1) At crowded Platform
- 2) Ticketing area (Front area of TVM and TOM)
- 3) Lift Car
- 4) Any other pre-defined area

4.8.3 Removed Object Detection

This analytic functionality shall be used to detect removal of pre-defined objects (thefts) in following areas, as a min:



- 1) At Platforms, concourses & back of house
- 2) At external locations (RSS, Mid Shaft etc.)
- 3) Any other pre-defined area

4.8.4 Overcrowding

This analytic functionality shall be used to detect overcrowding in following areas within camera coverage

- 1) At crowded Platform
- 2) Ticketing area (Front area of TVM and TOM)
- 3) AFC gates (Entry & Exit)
- 4) Station Entry
- 5) Any other pre-defined area

4.8.5 Loitering

This analytic functionality shall be used to detect unauthorised movement in following areas within camera coverage:

- 1) Back of house areas
- 2) Prohibited areas
- 3) Platform Edge Areas
- 4) Any other pre-defined area

4.8.6 Camera Tampering

This analytic functionality shall be used to detect tampering of cameras in following areas, as a min.:

- 1) TER gallery
- 2) Fireman staircase exit
- 3) Ramp
- 4) River Bridge
- 5) Mid-shaft
- 6) Station Entry / Exit
- 7) Lift Car
- 8) Any other pre-defined area

4.9 SYSTEM REDUNDANCY AND PROTECTION

4.9.1 Telecom Network for the CCTV System with required redundancy & protection shall be provided by FOTS Contractor on the IP-MPLS Network.

4.9.2 Single Point failure in CCTV system network using IP-MPLS Network provided by FOTS Contractor shall not affect availability of any system functionality.

Redundancy in the CCTV Network shall ensure failure of the CCTV Network within a station shall not affect operation of balance CCTV Network. Also, failure in any single Fibre Cable shall also not affect operation across the CCTV Network.

4.9.3 NOT USED



- 4.9.4** Protection switching shall comply to standard ITU-T recommended protection methodology and shall be seamless and be completed within < 50ms, with no disruption in any service.
- 4.9.5** CCTV Local Network for central servers & video walls, if provided by CCTV Contractor shall also be fully redundant at hardware level with complete network protection.
- 4.10 NETWORK SYNCHRONIZATION**
- 4.10.1 NOT USED
- 4.10.2 All Telecom systems within IP-MPLS Network shall be synchronized from Master Clock through NTP/PTP protocol over IP-Network
- 4.10.3 FOTS Contractor shall be responsible to provide accessibility of Master Clock IP address across the CCTV network configured / provisioned over the IP-MPLS Network.
- 4.10.4 An effective synchronization plan across CCTV network shall be proposed by the contractor for the Employer representative's approval.
- 4.10.5 NOT USED
- 4.10.6 NOT USED
- 4.10.7 NOT USED
- 4.10.8 Central Server/Domain Controller shall provide synchronization signal to all CCTV equipment from its own System clock in the absence of a reference timing input from Master Clock.
- 4.10.9 When synchronization reference is restored after failure, it is important that all CCTV equipment shall quickly re-qualify a restored synchronization reference, as is the ability of the system to holdover through the network outage so that synchronization is never out.
- 4.10.10 The FOTS system shall interface with the Master Clock System to provide required synchronisation protocol / signals as per details available in Appendix-A9, Chapter-3 (Interface –Roles & Responsibilities) of this PS.
- 4.10.11 It shall be FOTS contractor's responsibility that the NTP synchronization received from Master Clock is distributed reliably with-out any degradation through the IP-MPLS network to the Telecom and other systems network devices (i.e. SCADA, Signalling, IT, BMS, AFC etc) connected to IP-MPLS network.
- 4.11 NETWORK SECURITY**
- 4.11.1 All IP based CCTV equipment across CCTV network shall strictly comply the IT security policy as specified in clause 5.2.2, Chapter-1 (General Requirements) of the PS.
- 4.11.2 CCTV network shall not be accessible from any other Telecom system with which no interface is required.
- 4.11.3 To ensure of security of Video surveillance system (Camera & Software) from vulnerabilities & breaches and discourage false undertaking from OEMs, security auditing and testing of equipment including source code of camera and software shall be carried out from STQC (Ministry of Electronics & Information Technology) or any other Government Agency from the list of CERT-In empanelled Information Security Auditing Organization. In order to ensure security of network and other IT equipment of VSS, before bulk supply & installation, purchaser should ensure that security auditing and testing at the time of Factory Acceptance Test (FAT) of 1st Lot of material or as specified by purchaser. In case any security breach is found in the system at any stage, immediate strict penal action is to be initiated by the purchaser.
- 4.11.4 All OEMs involved in this system contract must submit a declaration certificate regarding their genuinity, have their own manufacturing setups and IPR for the hardware(s)/software(s), and



shall not have 3rd party manufacturing from any company blacklisted in India or abroad (due to proven backdoor access and data vulnerability) or any company sharing land border with India. The Intellectual Property Rights (IPR) of all manufactured final products and source code of all software including Camera firmware, VMS software & Video wall software etc. should not reside in countries sharing land borders with India, until unless specifically allowed by Government of India and is registered with the Competent Authority of Government of India. Proof of IPR & Source Code residing in which country and requisite permission & registration with Competent Authority of Govt. of India, as applicable to comply with the above, shall be provided by the OEMs. In case any breach or false declaration is found at any stage, immediate strict penal action is to be initiated by the purchaser



5. DESIGN REQUIREMENTS

5.1. GENERAL

5.1.1 The System design shall be based on a proven, reliable, scalable, secure standard – based solution using open architecture.

5.1.2 In addition to the Design Engineering requirements as identified in Chapter-1 of this PS , the CCTV shall meet the technical system performance and equipment specifications as detailed below:

- 1) Proposed CCTV system shall be an integrated IP based system using Non-Proprietary open standard with network centric functional and management architecture, aimed at providing high-speed manual/automatic operation for best performance.
- 2) All servers including Management servers and associated accessories used in the CCTV system shall be CE/FCC/UL certified COTS servers and shall be one of the following reputed makes i.e. IBM, Dell, HP, Sun Microsystems or equivalent. The contractor shall submit the details of servers proposed to be supplied for approval of the Engineer. The servers shall be supplied only after approval of the Engineer.
- 3) Video management Software, Workstation CCTV software, video recording software, Alarm and Report management software etc. shall work and integrate with any make of IT hardware like Server, Storage Array, Workstation, Network video recorder and networking devices etc.
- 4) The CCTV System i.e. IP cameras, Network Video Recorders and Software (Video Management and Video Recording) shall be compliant to global standards viz. ONVIF profile 'S' , 'G' & 'T'. This shall ensure all components of the CCTV system including IP cameras will interface with third party network video products.

The offered model should appear on the ONVIF website and a confirmation certificate for the offered models should be available at the time of supply.
- 5) For ease of maintenance , the IP cameras and all software (Video management, CCTV Work-station & Video recording) shall preferably be from the same manufacturer/OEM.

In case of Different OEMs for IP cameras and VMS softwares, both OEMs shall submit proof of satisfactory performance / working of their product with product of other OEM as per criteria specified in EQC clause 2.5 (2) for System specific OEM.
- 6) Lifetime licenses shall be provided for IP cameras, Video management Software, Video recording Software, Workstation CCTV software, Alarm and Report management software & any other equipment requiring license used in the CCTV system. The lifetime licenses provided shall also include the spare capacity of 25% of the installed capacity of all components of the CCTV system.
- 7) All Software License(s) should be provided in favour of Purchaser/User, either as paper or software license, as decided by the Engineer.
- 8) All control equipment e.g. servers, workstation (CPU), storage devices etc. shall be housed in TER/CER of each station/depot/OCC/BCC in standard racks (except Security Controller workstations of OCC, BCC, Depot & IT Park).
- 9) In RSS, servers, workstation (CPU), storage devices etc. shall be installed in a standard rack in airconditioned location mutually decided by CCTV and RSS Contractor. Compatible Layer-2 switch, if required, inside this standard rack for Connecting NVR, Workstation and field switches (to be provided by FOTS Contractor) shall also be supplied and installed by DS16 Contractor.
- 10) Failure of one camera shall not affect other cameras. Failure of one Recording Sever shall not affect recording of other servers. Failure of one Video Management system server shall not affect the other video Management System.



- 11) Primary and secondary fixtures suitable for height adjustment of ceiling mount cameras shall be provided.
- 12) The CCTV central management system in OCCs shall be installed on servers in a cluster of two servers or more. In event of failure of a server in the cluster, the other server in the cluster shall automatically take over functionality of the failed server.
- 13) A complete replica of CCTV central system (with all hardware and software) in main OCC shall also be provided in the BCC. So as to ensure transparent redundancy (1+1) between OCC & BCC , switching between the OCC & BCC systems shall be automatic. This event shall also result in a generation & reporting of a critical alarm on the management server.
- 14) Bidder shall provide Virtualized solution by having redundancy to all service applications, alarm management, Database, Management servers including other system applications in Virtualized manner to optimize the solution hardware etc.

Contractor may design the virtual network on physical hardware in such a way that system is capable of capturing live backup of the system in Backup server (Physical in N:1 redundancy).

In case of fail over mode, all services, alarm management, control management should be seamlessly transferred to the redundant server without any delay and operational interruption. In such a case redundant software of a sub-system/system shall reside in separate server(s) , other than primary application server(s), which should also work in Hot standby mode.

The contractor shall submit details of the solution proposed to be implemented for approval of the Engineer.
- 15) The Central management System shall include the management of all devices, servers and users for centralized monitoring, reporting, and alarm management software configuration uploads and downloads to client stations, firmware and software upgrades.
- 16) While certain brands of the hardware have been specified, considering the requirement of availability, maintainability and MTBF, it is essential that the brands out of those specified may be chosen by the tenderer so as to justify the MTBF and Availability of the entire system during the detailed design from the published figures in the data sheets and later substantiate the same during the DLP period.
- 17) The Tenderers shall be qualified based on their own experience as either being CCTV equipment manufacturers or CCTV system software developer or having adequate experience in commissioning of CCTV systems.

Accordingly, they are preferably required to choose and quote only for the makes of Cameras and other equipment of which they are the manufacturers, out of the list of recommended makes listed in this PS.
- 18) DS16 Contractor shall adopt the best standard of Labelling/tagging available in market. Labelling plan shall be submitted along with preliminary design for approval of the Engineer.
- 19) Every Non-BOQ item supplied by DS16 Contractor for CCTV system shall be a quality product with ISI standard.



5.2. EQUIPMENT SPECIFICATIONS

5.2.1 CCTV Cameras

Various types of cameras shall generally be provided as detailed below:

- 1) **Fixed Box Cameras:** shall generally be used for **indoor locations** i.e. concourse, AFC Gates, platforms, platform staircases, Escalators, corridors, foot over bridges, cross passages, subways, ticketing area(s), Depot buildings etc.
- 2) **Fixed Box IR Cameras:** shall generally be used for **outdoor locations** i.e. Staircase of Entry/Exit gates, Entry/Exit gates of Depot, Platform Tail-ends, Parking, periphery of RSS & Depot, SPCs, Ramp & River-Bridge etc.
- 3) **Fixed Dome IR Cameras:** shall generally be used to provide coverage of TER gallery, Platform head-ends, Mid-Shafts, Emergency Exit, Fireman staircase exit, DG room at underground station, ESPs at platforms and station Control room etc.
- 4) **Bullet Cameras:** shall generally be used for indoor locations i.e. Emergency exits, unpaid areas of concourse and DCC & ETU Building at Stations & Depots respectively.
- 5) **PTZ Dome IR Cameras:** shall generally be used to provide wider coverage of station concourse & depot with Pan, Zoom & 180^o Tilt facility so that Controller can monitor any desired location within its coverage area by manually adjusting it through Joystick/Mouse.
- 6) All Cameras shall have dual power options of PoE/PoE+ and 24V AC/12V DC/24V DC. CCTV Contractor shall interface with FOTS Contractor to ensure the availability of PoE/PoE+ ports as per CCTV requirements.
- 7) For the PTZ cameras, if the power (PoE/PoE+) available on the field switch port is not sufficient to drive/power the PTZ functionalities, a separate power cable shall be laid by CCTV contractor from nearest CCTV Rack and suitable power arrangement shall be made/provided to power the PTZ camera.
- 8) Ethernet output from IP cameras shall be directly connected to PoE ports of Industry Grade Layer-2 field switches (provided by FOTS contractor) through data cable and suitable protection devices.
- 9) Edge storage provisioned for each camera shall provide a min. of 2 days recording.
- 10) On recovery, after any failure of the Primary recording system, the edge storage recording of a particular camera(s) shall be down loaded to the Primary recording system so as to avoid a discontinuity and maintain continuity in the Primary and Mirror recording of that particular camera(s)
- 11) CCTV Contractor shall design distribution of all cameras at each location so as to comply with the coverage requirements and submit the same along with the CCTV camera coverage plots to the Employer's Representative for review and approval.
- 12) Unless otherwise specified elsewhere in the PS, Cameras, field switches, PF Monitors & other equipment, meant for outdoor installations, shall be suitable to work from 0°C to +60°C with RH up to 90% non-condensing.
- 13) The data sheets from the OEM of the cameras for outdoor and indoor are to be specifically conforming to the above in regard to the temperature and humidity requirements. The data sheets shall be submitted with the Technical Description in the bid documents.

5.2.2 Vari-focal Lenses:

- 1) Vari-focal Lenses shall be compatible with high resolution fixed box type cameras to provide best resolution/picture quality.

Vari-focal lenses shall have the following specifications as minimum:

Table 2.8: Vari-focal Lenses Specifications



S.No.	Parameters / Details	Quad HD Cameras (4 MP or better)	4K UHD Cameras
1)	Focal length	9mm – 40mm	12mm – 50mm
2)	Iris range	F1.5 to close	F1.5 to close
3)	Format	1/2.8" or better, Full HD/Quad HD, IR corrected.	1/1.8" or better, 8MP, IR corrected.
4)	Angle view wide	33° x 20° or better	33° x 19° or better
5)	Angle view Tele	6.6° x 3.8° or better	8.6° x 5.8° or better
6)	Iris Control	Automatic Control (DC Iris / P-Iris)	
7)	Lens mount	C/CS-mount	
8)	Focus Control	<ul style="list-style-type: none"> - Auto-back focus - Remote (i-CS or equivalent) control with Manual override or Manual control (as per requirement) 	
9)	Zoom Control	<ul style="list-style-type: none"> - Remote (i-CS or equivalent) control with Manual override or Manual control (as per requirement) 	
10)	Operating Temperature	0°C to +50° C	
11)	Storage Temperature	0° C to +60° C	
12)	Operating Humidity with camera and housing	Up to 90% RH, non-condensing	
13)	Approval (Safety& EMC Immunity, Emission)	CE or equivalent.	
14)	Make of Lens	<p>Only from a reputed OEM, subject to meeting the above requirements.</p> <p>Printed data sheet of manufacturer to be attached with the bid proposal, clearly identifying clause by clause compliance.</p>	

5.2.3 Housing Arrangement for Fixed Box type Camera:

- 1) Housing arrangement shall be designed for both outdoor and indoor use and shall meet requirements for camera enclosures.
- 2) It shall protect combination of both camera and lens.
- 3) Housing shall have sufficient inside space for camera, lens & data SPD.
- 4) The housing arrangement shall have the following technical specifications and features:

Table 2.9: Technical Specifications & Features for Housing

S.No.	Parameter / Feature	Requirement
1)	Window	3 mm (0.12 inch) glass (photo chromatic)
2)	Camera Mounting	Removable camera/lens tray mounted with minimum two screws or other industry standard arrangement.
3)	Cable Entry	Internally concealed with suitable ingress protection. No Cable should be visible from outside.
4)	Material	Aluminium / fibreglass Reinforced Composite / Polycarbonate housing & casing , neoprene gaskets , UV-resistant polymer end caps.
5)	Tamper-resistance	Tamper-resistant screws for locking clasps
6)	IR illuminator	<p>Integrated or External Infra-red illuminator complying to IP-66/NEMA-4x or better with range of 50 mtr. or more. The infra-red illuminator shall be of specifications as detailed in this chapter & shall be of same make as Housing.</p> <p>The Infra-Red illuminator shall be powered from the same PoE+ port used for the camera (powering of the IR illuminator shall be integrated with the camera).</p>



S.No.	Parameter / Feature	Requirement
7)	Wiper Arrangement	Reqd. for outdoor locations (where specified)
8)	Housing Power Supply	PoE+/HPOE (same port used for the camera) (for powering IR illuminator & Wiper arrangement)
9)	Vandal resistance	IK 10 or better.
10)	Enclosure Protection	IP-66/NEMA-4x or better
11)	Operating Temperature	0° C to +60° C
12)	Humidity	Up-to 90%, RH non-condensing
13)	Regulatory Approvals/Certifications	UL/EN/CE/IEC/BIS certification for safety and CE/FCC Certifications for EMC & immunity. Note: Regulatory Approvals/Certifications are to be provided from NABL/NABCB accredited Labs or internationally reputed and accredited Labs/Agencies.
14)	Makes subject to meeting the above requirements.	The Housing shall either be integrated with the camera by the manufacturer or it shall be of same make as the camera. Printed data sheet of manufacturer to be attached with the bid proposal, clearly identifying clause by clause compliance.

- 5) The Housing shall either be integrated with the camera by the manufacturer or it shall be of same make as the camera.
- 6) While the housing shall be powered with PoE+/HPOE, it should also support input power of 110 VAC- 230VAC.

5.2.4 Mount for the Camera:

- 1) Mounts shall be suitable for indoor and outdoor mounting units designed for fixed cameras or camera housing installations. The mount shall be of the same make as housing.
- 2) Mount shall have the following features:
 - i) Feed-through design for cable management
 - ii) 360° rotation, 180° tilt
 - iii) Versatile design
 - iv) Adjustable mount heads
 - v) Corrosion-resistant finish.
- 3) Suitable mounting arrangement shall be provided for the alignment of camera Housing. It shall be easy to make adjustment in orientation of camera as per site requirement. Position of camera housing should not be changed due to high wind flow, vibration or minor vandalism, once adjusted and tightened.

5.2.5 IR-Illuminator

The Infra-Red (IR) illuminator for Fixed Box Camera (integrated (with camera or housing) or external) shall provide high quality 850 nm or better IR illumination as per specifications detailed below:

Table 2.10: IR Illuminator Specifications

S.No.	Functionality	Specification
1	LED type	Semi-covert IR LED or better
2	Wavelength	850nm
3	Power	Dual Power - PoE/PoE+ and AC 24V (It shall be powered with the same source as the associated camera and housing)



S.No.	Functionality	Specification
4	IR distance	50 mtrs. (120 mtrs for PTZ cameras)
5	Angle	115°
6	Power consumption	11 W (850nm)
7	Day and night switch	Auto (build in photocell)
8	Cable length	1.3 meter or as per requirement
9	Mounting Wall mounting	“U” bracket (Pan/Tilt)
10	Temperature	0°C to 60°C
11	Grade of protection	IP-66
12	Color	As per station aesthetics
13	Housing	Aluminum
14	Panel	High light transmittance toughened photo chromatic glass

The IR function can be controlled via the video output of the camera and or the camera's IR-cut filter can be synchronized via a contact closure in the housing.

5.2.6 Specifications for following IP Colour Cameras (Day/Night):

- 1) Fixed Box IP Colour Camera (Quad HD or better)
 - 2) Fixed Box IP Colour Camera (4K UHD or better)
 - 3) Fixed Dome IP Colour Camera with IR illuminator (Quad HD or better)
 - 4) High Speed, PTZ Dome IP Colour Camera (Quad HD or better)
 - 5) Corner Lift IP Colour Camera (Full HD or better) (to be supplied by Lift contractor) **except the quantities specifically included in the BOQ.**
 - 6) Bullet Camera (Quad HD or better)
- are enclosed at **Annexure 5** of this document.

5.2.7 Specifications- Digital CCTV Keyboard:

- 1) Digital keyboard (joystick) shall be fully functional, multipurpose keyboard used for controlling of connected P/T/Z cameras.
- 2) Digital keyboard shall include an integral variable speed pan/tilt/ zoom joystick and shall be able to select any P/T/Z camera and display it on any monitor of that location
- 3) Digital keyboard shall control multiple P/T/Z cameras
- 4) Digital Keyboard shall support USB 2.0 port interface and shall be supplied with required interface units.
- 5) Digital keyboard shall be of same make as P/T/Z camera.
- 6) Digital keyboard shall be equipped with user-friendly menu displayed on LCD with dynamic menu and easy to read display.
- 7) Digital keyboard shall automatically number monitors, cameras, sequences and guard tours. Users shall view video on monitors in the same way as controlling a matrix
- 8) Digital Keyboard shall be able to withstand 0°C to + 50°C temperature and humidity of 20 to 80% RH (non-condensing).
- 9) Digital Keyboard shall be UL/EN approved for safety and CE/FCC and approved for EMC & immunity.

5.2.8 Workstation PC

PC for the workstation shall include CPU unit, USB keyboard, USB mouse with one or two 4K display monitors.



Rack Mountable CPU unit shall be installed inside TER/CER and display monitors shall be installed near the associated Controller for viewing /monitoring / controlling the cameras.

The workstation and associated display monitor shall be compliant to specifications mentioned in Appendix N, Chapter-4 (Appendices) of this PS.

5.2.9 **4K KVM-HDMI Extender**

At locations where workstations for CCTV MMIs are housed/located in Telecom Equipment Room (TER) / Central Equipment Room (CER) , extension of Video, Key board, Mouse and CCTV joystick to the OCC Controllers, Station/Depot Control Room (SCR/DCR), Security Rooms and Platform Supervisor Booths (PSB) in OCC/stations (as the case may be) shall be done through KVM Extenders.

For Dual monitor MMIs, KVM-HDMI Extenders shall be provided for connectivity of both the monitors.

- 1) The distance between TER and SCR/DCR/Security Rooms/PSB in some cases may be more than 150 mts. The KVM extenders shall be selected keeping in view of the distance and the screen resolution of MMI.
- 2) The KVM-HDMI extenders shall be compliant to specifications mentioned in Appendix N, Chapter-4 (Appendices) of this PS.

5.2.10 **Network Video Recorder**

1) **Network Video Recorder (Server/Storage) - General requirements**

- i) The recording servers shall be used for recording video & audio feeds /signals and for communicating with cameras and other devices. The recording server(s) shall be able to communicate with the management server.
- ii) All camera recordings shall have Camera ID & location/area of recording as well as date/time stamp and shall be programmable by the system administrator with User ID & Password.
- iii) Video stream as well as audio stream (configured as per requirement) from individual cameras shall be recorded on the storage device.
- iv) The storage capacity of the NVR system shall be for recording (audio & video) for a min. of 7 days.
- v) System shall have provision to automatically purge old data in FIFO format when the storage space is exhausted. Under no circumstance, storage space usage etc., shall the server hang / stop the recording process. All data available in the storage device should be possible to be retrieved.
- vi) The CCTV application should allow retrieval of data instantaneously for any date / time interval chosen through search functionality of the application software.
- vii) The NVR shall provide Network Time Server function to ensure time synchronisation, with the Master Clock system, of the Video Servers and the recordings.,
- viii) The NVR shall provide a status of the available recording capacity, as well as an indication of the remaining possible recording time. An alarm shall pop-up on the workstation/terminal when the storage device is nearly full and before overwriting by FIFO process is initiated.
- ix) Once configured, recording servers shall run independently of the management server, and shall continue to operate even if the management server is offline.



- x) Network video recorders (NVRs) shall be designed to operate in a mirrored redundancy mode. The station cameras will be recorded in primary NVR server at the station/location itself and in mirrored mode at a pre-defined station/location as detailed in Para-4. The system shall support an unlimited number of recording servers.
- xi) Each recording server shall have a default storage container. The storage container shall specify the complete recording and archiving configuration. The Software shall be able to record (video) on any of the following options:
 - i) inbuilt hard disks on the server,
 - ii) Direct Attached Storage boxes attached to servers, Network Attached Storage or
 - iii) Storage Area Network.
- xii) System should ensure that once recorded, the video cannot be altered, ensuring the audit trail is intact for evidential purposes.

Water marking alone for ensuring tamper proof recording is not sufficient and this shall be additionally achieved using Authentication with minimum SHA-256 hashing function or latest, secured with 1024-bit RSA public-private key pair encryption. The VMS must support digital signature to prove authentication and integrity. Tamper proof recording mechanism which meets security of minimum AES-128 encryption shall be implemented.
- xiii) System must be capable of protecting video (based on Alarms or certain parameters) so as to prevent it from being deleted.
- xiv) The system shall support min. of the following compression formats i.e. H.265, H.264, MPEG-4 (Part 2), MPEG-4 ASP, MPEG, and MJPEG.
- xv) The recording server shall utilize high performance iSCSI, SCSI, SAS or SSD disk drives for online recording storage. Use of online archiving shall ensure that data is always readily available.
- xvi) There shall be no loss of frames while recording the video signals of the CCTV cameras in the recording system
- xvii) All Hardware including the Hard-disks used in the CCTV system shall be suitable to function 24*7 under corrosive environment.
- xviii) The Hard-disks shall have suitable balancing arrangement to withstand vibrations.
- xix) The online archiving capability shall be transparent and shall allow viewing client users to playback archived recordings without the need to restore the archived video to a local hard drive for access.
- xx) The system shall allow the frame rate, bit rate and resolution of each camera to be configured independently for recording. The system shall allow the user to configure groups of cameras with the same frame rate, bit rate and resolution for efficient set-up of multiple cameras simultaneously.
- xxi) The system shall provide seamless access to recordings on the failover server for all clients through the same client views once the services are fully started

2) Network Video Recorder (Server/Storage) - Hardware

- i) The Network Video Management and Recorder system shall be based on Commercially off the shelf (COTS) 19" Rack Mountable servers.



- ii) The storage shall comprise of dual groups of RAID-5 or better with inbuilt hard disks (Hot swappable) on the COTS server Minimum usable storage space for each RAID group (Primary or Secondary) shall be 48 TB with a provision of expansion of up to 25%. Each Hard-disk of the RAID group shall be of min. 16 TB capacity.
- iii) The NVR servers shall meet the following specifications as a minimum:

Table 2.11: NVR Servers Specifications

S.No.	System	Specification / Requirement
1)	Processor	Latest Intel Xeon scalable dual processor (3.2 Ghz or better) with Hyper-Threading with minimum 9.6 GT/sec QPI speed, 15MB L3 cache, configured with Redundant Power Supplies
2)	No. of Cores per Processor	8 core or better
3)	No. of Threads per Core	2
4)	Memory	16 DD4 RDIMM slots, 64 GB or higher if required, scalable up to 512 GB @2666MT/s.
5)	OS hard drive	Minimum 2 x 480 GB SSD in RAID 1 Random Read IOPS (QD1) – up-to 14,000 IOPS Random write IOPS (QD1) – up-to 50,000 IOPS
6)	Inbuilt Storage	Front drive bays available for minimum 10 x Hot pluggable 3.5” NL-SAS/ SAS disk drives. Speed: 7.2K RPM or better RAID groups = 2 of equal size (minimum 48 TB) Total Storage capacity (with two RAID groups): 96 TB or higher if required.
7)	Drive controller	Dual SAS controller with RAID 5 or better (separate for each RAID group)
8)	Optical Storage	DVD ROM Drive required
9)	Network Controller	2 x 1G and 4 x 10G Copper Ethernet Ports with factory crimped copper Ethernet Patch Cords for Each Port (1G/10G). - These Ethernet ports shall have the capability of load balancing and fail over support. - Remote management card with IPv4/IPv6 compliance.
10)	Power supply	Two (redundant) hot pluggable high efficiency rated power supplies.
11)	Management	Dedicated Remote management card, with support for full out of band remote management. Remote management system to provide Firmware updates and Roll back without installing any software.
12)	OS	Latest Windows Server/Linux or as required for CCTV system operation.
13)	Approvals	The Network Video Recorder shall be CE/FCC/UL listed and shall be one of the reputed makes such as IBM, Dell, HP, Fujitsu, Sun Microsystems or equivalent subject to meeting the above specifications. The Server accessories shall also be CE and UL listed. The CCTV contractor shall submit a proposal indicating the make & model of the proposed NVR Server to the Engineer for review & approval. The NVR Server shall be procured only after receipt of no-objection from the Engineer.



5.2.11 **Video Surveillance Software**

- 1) The software shall be based upon standard components and proven technology using open and published protocols.

All the software and licenses shall be for perpetual use by DMRC. This applies for all kind of software and licenses being supplied as part of the CCTV contract.

- 2) The video management system shall be an enterprise class IP enabled fully distributed solution, designed for limitless multi-site and multiple server installations requiring 24/7 surveillance with support for devices from different vendors.

- 3) The video management system shall offer centralized management of all devices, servers and users for centralized monitoring, reporting, and alarm management, software configuration uploads and downloads to client stations, firmware and software upgrades.

These functionalities shall be implemented on workstations available in CSS rooms.

- 4) The video management system shall allow an unlimited number of cameras, recording servers and clients to be connected to management server across multiple sites.

- 5) The video management system shall include a distributed architecture, allowing clients on the host system with the user rights to view video sources belonging to multiple independent video management systems simultaneously.

- 6) The video management system shall contain a management server that shall be the central manager of the system and control recording servers, cameras, devices and users. The management server shall handle the initial client login, system configuration and logging.

It shall be possible only for registered users to Log-on to the system including in event of failure of the central Video Management System.

- 7) The video management system shall include an alarm management function that shall provide central overview, control and scalability in any number of federated video management system installations.

- 8) The video management system shall support/enable high availability of recording servers. A failover option shall provide standby support for recording servers with automatic/seamless synchronization/switching to ensure maximum uptime and minimum risk of losing data.

- 9) The video management system shall support a versatile rule system including scheduled or event-driven actions with numerous options, including support for time profiles.

- 10) The video management system shall incorporate a fully integrated video-sharing functionality for distributed viewing of video from any camera in the system on any computer with the viewing client.

- 11) The video management system shall support a video wall application, which shall be flexible and hardware independent to allow for seamless integration with the management client and viewing client.

- 12) The video management system shall support encryption of video for export purposes.

- 13) The video management system shall include a standalone viewing client application to be included with video exported from the viewing client application. The standalone viewing client application shall allow recipients of the video to browse and playback the exported video without installing separate software on their computers



- 14) The video management system software shall provide fast evidence export by exporting video in various formats, including video from multiple cameras in an encrypted database format with an included standalone viewing client.

It shall be possible to write a digital signature to the database files containing recorded data. This shall allow the viewing client and the standalone viewing client to verify that the contents of imported and opened databases have not been tampered with and that no database files have been removed.

- 15) The video management system shall support a solution that makes it possible to integrate multiple third-party video content applications seamlessly into viewing client environments.
- 16) The video management system shall include a Software Development Kit (SDK)/ API that offers important capabilities for integrating/interfacing the video management system with third party software and applications/systems like access control, ESP Control, Help Point Control, Video analytics, etc.

This should enable of the CCTV System Interface with the Signalling (ESP) & SIP-PBX (Help Point) at Central level between both the Systems viz. Signalling & CCTV and SIP-PBX & CCTV etc.

- 17) The video management system shall include support for Active Directory to allow users to be added to the system. Use of Active Directory requires that a server running Active Directory, acting as a domain controller is available on the network.
- 18) The VMS shall support generation of audit trails. Audit trails shall consist of logs of actions done by operator/administrator e.g. login/logout, additions, deletions, and modifications, etc. The VMS shall support Audit trails report generation from the audit trail database into standard reporting tools e.g. CSV /Excel etc.
- 19) The system shall allow the recording, live monitoring, playback of archived video simultaneously.
- 20) The system shall support multicasting of video feeds to client workstations in order to conserve network resources. Multicasting shall send a single stream of video to multiple clients, where the stream may be decoded and displayed on all clients simultaneously. The system shall automatically switch to unicast, if the client fails to connect to the multicast stream.
- 21) The system shall allow live multi-streaming from the cameras in different resolutions, formats, and frame rates. In addition to this, the system shall support a separate recording stream.

The VSS shall also have the functionality of using adaptive streaming functionality of the cameras, wherein the camera stream is dynamically adjusted as per requirements of workstation(s) and/or the network. This functionality would also result in rational/economical use of network resources.

- 22) The system shall support a built-in Virtual Matrix Switcher. The Virtual Matrix Switch shall have the capability of creating camera sequences with the following functionalities:
- i) Each Sequence shall have capability up to hundreds of cameras.
 - ii) Each camera in the sequence shall have its own individual dwell time, from 1 to 60 second.
 - iii) Each entry in a sequence shall have the capacity to trigger PTZ camera presets, patterns or auxiliaries.



- iv) Multiple users shall be able to view the same camera sequence simultaneously, not necessarily synchronized one with the other.
- 23) The OEM shall provide the Software Development Kit for smooth integration of CCTV system with other telecommunication systems specified in this technical Specification.
- 24) The contractor shall submit a detailed design proposal for implementing the above functionalities in the proposed VSS system for approval of the Engineer.

5.2.12 Specifications of VMS & Alarm Management Server(s)

Specifications of both the VMS & Alarm Management Server(s) shall be as detailed below:

Table 2.12: VMS & Alarm Management Servers Specifications

S.No.	System	Specification / Requirement
1)	Processor	Latest Intel Xeon scalable dual processor (3.2 Ghz or better) with Hyper-Threading with minimum 10.4 GT/sec QPI speed, 18MB L3 cache, configured with Redundant Power Supplies
2)	No. of Cores per Processor	8 core or better
3)	No. of Threads per Core	2
4)	Memory	16 DD4 RDIMM slots, 128 GB or higher if required, scalable up to 512 GB @2666MT/s.
5)	OS hard drive	Minimum 2 x 1024 GB SSD in RAID 1 Random Read IOPS (QD1) – upto 14,000 IOPS Random write IOPS (QD1) – upto 50,000 IOPS
6)	Inbuilt Storage	Front drive bays available for minimum 8 x Hot pluggable 3.5"/2.5" NL-SAS/SAS disk drives. Speed: 7.2K RPM or better Storage capacity: 48 TB or higher if required
7)	Drive controller	SAS controller with RAID 5 or better
8)	Optical Storage	DVD ROM Drive required
9)	Network Controller	- 2 x1G and 4 x 10G Copper Ethernet Ports with factory crimped copper Ethernet Patch Cords for Each Port (1G/10G). - These Ethernet ports shall have the capability of load balancing and fail over support. - Remote management card with IPv4/IPv6 compliance.
10)	Power supply	Two hot plug (redundant) high efficiency rated power supplies.
11)	Management	Dedicated Remote management card, with support for full out of band remote management. Remote management system to provide Firmware updates and Roll back without installing any software.
12)	Operating Systems and Virtualization Software Support	Windows Server 2016 or latest Microsoft Hyper-V Server 2016 or latest or as required for CCTV system operation.
13)	Approvals	The VMS sever/Alarm & Report Management Server shall be CE/FCC/UL listed and shall be one of the reputed makes such as IBM, Dell, HP, Fujitsu, Sun Microsystems or equivalent subject to meeting the above specifications. The Server accessories shall also be CE and UL listed The CCTV contractor shall submit a proposal indicating the make & model of the proposed VMS Server to the Engineer for review & approval. The VMS Server shall be procured only after receipt of no-objection from the Engineer.



5.3. EQUIPMENT DESIGN

5.3.1 General

- 1) CCTV System shall be designed to meet all requirements of CCTV surveillance and maintenance with user-friendly GUI at application level.
- 2) All CCTV equipment other than cameras shall be housed inside a standard rack/Junction Boxes with all required accessories i.e. Power arrangements, Cable Manager, Fan Assembly & Locks etc.
- 3) Lighting arrangement shall also be provided inside 42U standard rack for TER/CER with auto on/off on door opening/closing.
- 4) For easy access to maintenance, all cameras and Junction Boxes inside the station shall be installed below the false ceiling at the height not exceed to 3 mtr.
- 5) Hot-swapping of the plug-in units shall not affect the equipment operation. The equipment shall be housed in closed Racks only, with proper ventilation.
- 6) Cable Termination Plan and Equipment Layout on a laminated paper sheet shall be displayed inside every Rack/Junction Box.
- 7) Every Rack/Junction Box at station, Depot & RSS shall be marked with unique identification number.
- 8) All opening/Hole/Cut-out provided inside rack for cable routing should be properly sealed.
- 9) The contractor shall ensure requirements of the specifications pertaining to interfaces are properly complied.

5.3.2 CCTV Cameras

- 1) CCTV Cameras shall be installed at stations, Depots, RSS, and other outdoor locations to meet all coverage requirement mentioned in clause 4.2 of this chapter.
- 2) Every camera at station, Depot & RSS shall be marked with unique identification number.
- 3) Data and Power cables terminated to any camera shall be concealed and routed through hollow Fixture and GI Conduit.

5.3.3 CCTV Servers (VMS), Recorders and Workstations

- 1) CCTV central server shall be designed to configure all CCTV cameras, workstation and recorders. CCTV central Server shall have the provision to maintain a database of all configuration with backup and restore feature.
- 2) A complete replica of CCTV Central system (with all hardware and software) in Main OCC shall also be provided in BCC. Any change in database of active server shall immediately be replicated to redundant server.
- 3) In Central Server, Domain Controller shall be available as a separate virtual machine for proper authentication of system users across the CCTV network.
- 4) All workstation and recorders shall be configured as part of distributed architecture of CCTV System.
- 5) All IP based equipments i.e. Cameras, Servers, Recorders & workstations should be accessible from every Server, Workstation & Recorder across the CCTV network.
- 6) All servers, recorders and workstations shall be rack based, suitable for 19" rack.



5.3.4 Network Management System (Alarm & Report Management System)

- 1) Network Management system shall be fully redundant (1:1 Configuration)
- 2) A user friendly GUI shall be provided for Network Management system for easy monitoring of alarm and report generation.

5.3.5 Video wall Management System

- 1) Control and management server (Display Controller) for video wall shall be fully redundant (1:1 configuration).
- 2) Decoding units in video wall system shall be configured in N:1 Configuration.
- 3) CCTV System shall be compatible to integrate with existing video wall management system of Phase-III.

5.4. CABLING AND ACCESSORIES

- 1) The specifications of all cables shall be as given in the Cabling Specification in Appendix-D , Chapter 4 (Appendices) of this Particular Specification.
- 2) Requirements on cabling accessories, optical distribution frames, main distribution frames and Ethernet Patch Panel, in addition to, Appendix-D & Appendix-Q, Chapter-4 (Appendices) of this PS , shall also comply to provisions given in Chapter-1 of this Particular Specification.

5.5. POWER SUPPLY DISTRIBUTION

5.5.1 Introduction

- 1) All equipment of CCTV system shall work on 180 - 240 VAC single phase UPS power supply, provided by PIDS-PAS (DS15) Contractor.
- 2) CCTV contractor shall provide power supply modules with associated surge arresters etc. as required for satisfactory performance of various equipment of the CCTV system.
- 3) For cameras located in proximity / close to the 25 KV traction systems at stations/Depot/RSS, Suitable data, power and video cables shall be provided with proven and of adequate rating surge suppressers, both at the camera and at the TER end.

Notwithstanding the above, the cameras shall be located, so as to avoid interference from 25 KV AC.

5.5.2 AC Power Supply Distribution

- 1) Dual, 3 phase 415 V AC power supply from UPS viz. UPS-1 & UPS-2 , shall be extended and terminated on a busbar in an UPS AC Distribution Board (ACDB) equipped with MCBs for Signal, Telecom , PSD, AFC & E&M systems by the UPS contractor in the S&T power supply room.

The interface point between the UPS and Signal, Telecomm. , PSD , AFC & E&M systems shall be MCBs provided in the UPS ACDB (provided by UPS contractor).

- 2) PIDs/PAS (DS15) Contractor shall extend the 3 phase 415 V AC Power supply from UPS ACDB (provided by UPS contractor) to Telecomm. ACDB in TER (to be provided by PAS Contractor along with MCBs for IT & each Telecomm. Sub-system) with a spare cable set (1+1) to meet the AC Power requirements of IT & all Telecom sub-systems. Spare cable used above shall be of the same capacity as the main cables in use. Interface of IT & all Telecomm. sub-systems shall be through MCBs in the Telecomm. ACDB (provided by PIDS & PAS Contractor).



The PIDs/PAS (DS15) Contractor shall further extend the UPS Power supply from the TER ACDB to LCBs on UP Platform, DN Platform & Concourse provided for distribution of power supply to end equipment (PIDS, CCTV, FOTS, Clocks etc.) of all Telecomm. Sub-systems.

- 3) The AC distribution system provided by PA/PIDS (DS15) Contractor shall meet with the requirements of IT & all Telecom contractors. Distribution circuits shall be suitably protected with MCBs, Earth Leakage Detectors and SPDs etc.

DS16 (CCTV) Contractor shall lay Power Cables from Telecomm. ACDB & LCBs for powering CCTV system equipment in TER and external locations (UP/DN Platforms, Concourses)

All IT& Telecom system Contractors shall lay cables from respective MCBs in the Telecomm. ACDB & LCBs for powering their equipment Racks & end equipment supplied and commissioned under their respective Telecom and IT contracts and installed in TER and UP/DN Platforms & Concourses respectively.

- 4) The DS16 contractor shall ensure that the MCBs used in the system shall follow the general rule of hierarchal decrease in ratings from source of power supply to the end equipment (load) in the AC power flow chart
- 5) Power supply arrangement and specification has been detailed in Appendix A2 (Section B) & Appendix A4 of Chapter-3 (Interfaces – Roles & Responsibilities) of this PS.

The CCTV (DS16) Contractor shall submit design of the PS distribution system to the Employer's Representative for review and approval.

5.6. SURGE PROTECTION & EARTHING ARRANGEMENT

5.6.1 Surge Protection

- 1) All the equipment shall be protected from induced current, voltage as per CCITT Regulations against 25 KV AC Catenary carrying 1000 Ampere Current. Protection should be provided against all surge/transient voltages
- 2) External surge protection devices should be used at the input of all vulnerable equipment for effective transient protection as specified in Appendix-I of Chapter-4 (Appendices) of this PS.
- 3) SPDs shall be used for data & power cables present in the vicinity of high voltage lines for surge protection.

5.6.2 Earthing Arrangement

- 1) All indoor/outdoor CCTV equipment shall be earthed properly as per guidelines laid down in **Chapter 1** (General Requirements) of this PS.
- 2) Earthing arrangement in the TER/CER shall be provided by E&M contractor on an MET - bus bar with value less than one ohm (approx.) as defined in the Interface document.
- 3) The MET in the TER shall be extended to a sub-MET in Concourse & Platforms by PA/PIDS contractor (DS15).
- 4) Earthing of all CCTV racks & equipment installed in the TER, Platforms & Concourses etc. shall be done through the MET &/or sub-MET and shall be the responsibility of CCTV (DS16) contractor.
- 5) The earthing shall be done using earth cable of 16 sq. mm (min.) & 4 sq. mm copper of ISI make for Racks in the TER & End equipment (Racks, CCTV cameras etc. on platforms, concourses etc.) respectively,



- 6) All metallic enclosures, racks and Poles shall be provided with an earth terminal.

5.7. System Expansion

In addition to the requirements given in Chapter-1 (General Requirements) of PS, requirements on expandability of the CCTV System is detailed as under:

- 1) The Wired (spare) capacity shall include the spare capacity (min. 25%) to be provided in the system without requiring any additional wiring or rack. The wired capacity shall be possible to be implemented by providing only additional modules / cards in existing racks for implementation without any additional software & licenses.
- 2) It should be possible to configure additional Cameras at a station by the Engineer's representative without any requirement of any additional license / hardware.
- 3) It should be possible to configure additional CCTV system locations on the Network and interface/Integrate the same with the central Video Management system.



6 INTERFACE REQUIREMENTS

6.1 GENERAL

Interface requirement with different project Contractor is specified herein

6.2 INTERFACE SPECIFICATIONS

6.2.1 Details of interfaces with various Telecomm. and other systems/sub-systems have been provided as various Appendices in Chapter-3 (Interfaces – Roles & Responsibilities) as tabulated below:

Table 2.13: Interface Appendices

Appendices	Interface Description
A1	Interface between Civil/Track/DDC/Architect and i) Tunnel ventilation, ECS, E&M, Power Supply, S&T, AFC, Escalators, Lift's contractors ii) Signalling, Telecommunication, AFC, PG/PSD & UPS(S&T) contractors
7	Interface between Signalling, Telecommunication, AFC, PG/PSD & UPS(S&T) Contractor(s) and E&M/Traction/TVS/ECS Contractor(s) of Underground stations, Elevated stations and Depots of Phase-IV.
A3	Interface between CCTV System & Signalling & Train Control System contractors
A4	Interface between UPS(S&T) System and Signalling, Telecommunication, AFC, PG/PSD contractors for Power Supply Requirements
A5	Interface between designated PAS/PIDS/MCLK system and Telecommunication sub-system(s) & IT system contractors
A6	Interface between Central Telecommunication Fault Reporting System (CTFRS) and Telecommunication sub-system(s) & UPS (S&T) contractors
A7	Interface between all Telecom sub-systems, Central Telecommunication Fault Reporting System (CTFRS) AND Super-SCADA (SS) Contractor(S)
A8	Interface between FOTS and Telecom sub-system(s) & other (external) system contractors
A9	Interface between Master Clock system and Telecom sub-system(s) & other (external) system contractors
A10	Interface between Telephone system and Radio system contractors
A11	Interface between Telephone system and PAS/PIDS/MCLK system contractors
A12	Interface between Radio system and PAS/PIDS/MCLK system contractors
A13	Interface between Telecom (Radio system, FOTS, PIDS) and Rolling stock contractors
A14	Interface between Radio system and Signalling system contractors
A15	Interface between PAS/PIDS system and Signalling system contractors
A16	Interface between Signalling system and Rolling Stock contractors
A17	Interface between Signalling system and PSD contractors
A18	Interface Standards
A19	Interface between Telephone system and CCTV system contractors
A20	Integrated Project Monitoring System (IPMS)

6.2.2 Provision of false floor in TER shall also be responsibility of respective system contractor as per Appendix-J of Chapter-4 (Appendices) of this PS. Specifications for the False Floor/Base Frame/Under Floor Trays shall be as detailed in Appendix-K of Chapter-4 (Appendices) of this PS.



ANNEXURES

**Annexure-1****Contract Spares (CCTV System)**

S.No.	Items	Unit	Line-7 Extn.	Line-8 Extn.		Line-10 Extn.		Total
			Maujpur - Majlis Park	Janakpuri- Majlis Park (incl.)	Majlis Park (excl.)-R.K. Ashram	Aerocity- Neb Sarai (incl.)	Neb Sarai (excl.)- Tughlakabad	
1-A	Fixed Box Camera (Quad HD or better) with all accessories as per PS.	Nos	13	24	17	17	13	84
1-B	Bullet Camera (Quad HD or better) with all accessories as per PS.	Nos	2	4	3	3	2	14
2	Fixed Dome IR Camera (Quad HD or better) with all accessories as per PS	Nos.	6	10	8	8	6	38
3	PTZ Dome IP Camera with all accessories as per PS	Nos.	1	2	3	3	1	10
4	Fixed Box IR Camera (4K Ultra HD - Manual Control) with all accessories as per PS	Nos.	4	8	6	6	4	28
5	Fixed Box IR Camera (4K Ultra HD - Remote Control) with all accessories as per PS	Nos.	4	8	6	6	4	28
6	Corner Lift Camera (Full HD or better)- with all accessories as per PS	Nos.	2	3	2	2	2	11
7	Local Work Station (complete MMI with one 32" 4K monitor) as per PS	Nos.	1	1	1	1	1	5
8	Local Work Station (complete MMI with one 24" 4K monitor) as per PS	Nos.	1	1	1	1	1	5
9	Key Board with Joy stick as per PS	Nos.	1	2	3	3	1	10
10	NVR Server with RAID 5 configuration as per PS	Nos.	1	1	1	1	1	5
11	Surge Protection Devices for each power and each data circuit termination at both device and equipment ends as per specifications	Nos.	30	60	40	40	30	200
12	Armoured Cat5e or better cable as per PS	Mtr.	75	150	100	100	75	500
13	Unarmoured Cat5e or better cable as per PS	Mtr.	75	150	100	100	75	500
14	Armoured Power Cable as per PS	Mtr.	75	150	100	100	75	500
15	Unarmoured Power Cable as per PS	Mtr.	75	150	100	100	75	500
16	KVM TX/RX Pair	Nos.	2	4	3	3	3	15



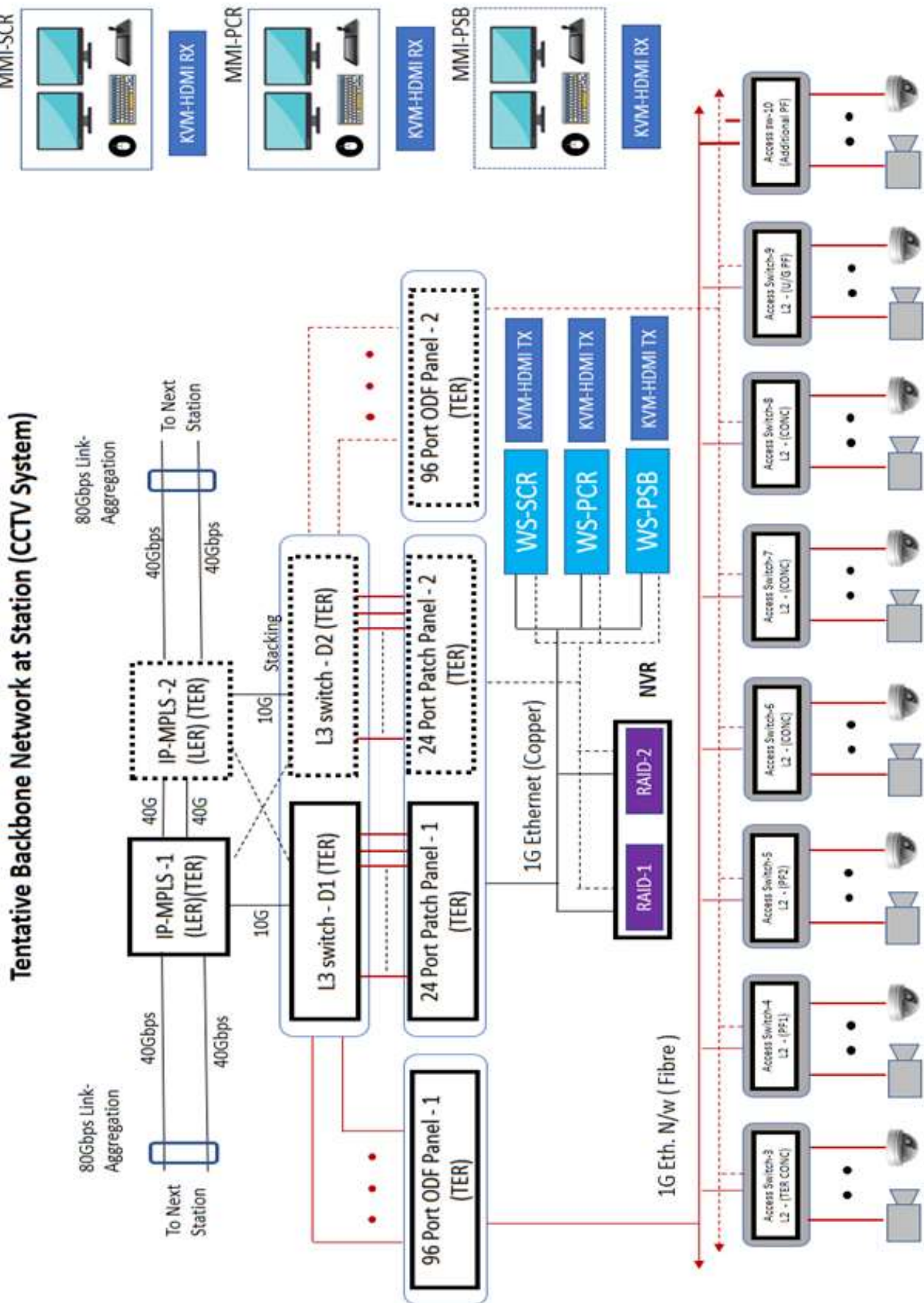
Annexure-2

Special Tools & Test Equipment (CCTV System)

S No.	DESCRIPTION	UNIT	MAKE & MODEL	TOTAL
1	LAN/WAN Analyzer 10 G	No.	JDSU/6865A or Fluke DTX 1800	1
2	Optical Laser Source	No.	OLS 35 or Equivalent	2
3	Optical Power Meter	No.	OLP 55 or Equivalent	2
4	LAN/Data Tester	No.	MASTER – NS 468	4
5	Laptop Complete with all Software & licenses as per GS and PS.	No.	As approved by DMRC	5



Annexure 3



**Annexure 4****Quantities of various types of Cameras & their Locations (typical) planned at every;**1) **Elevated station**

S.No.	Location	FB Camera (Quad HD) (nos.)	Bullet Camera (Quad HD) (nos.)	FBIR Camera with Manual Focus & Zoom Control (4K UHD) (nos.)	FBIR Camera with Remote Focus & Zoom Control (4K UHD) (nos.)	FDIR Camera (Quad HD) (nos.)	Lift* Camera (Full HD) (nos.)	PTZ Camera (Quad HD) (nos.)	Total Cameras (nos.)
1	UP Platform (for 6 Coaches)	5	0	1	0	1	0	0	7
2	DOWN Platform (for 6 Coaches)	5	0	1	0	1	0	0	7
3	CONC-PF Staircase (UP)	4	0	0	0	0	0	0	4
4	CONC-PF Staircase (DOWN)	4	0	0	0	0	0	0	4
5	Lift (UP & DOWN PF)	0	0	0	0	2	2	0	4
6	ESP/PSB (UP & DOWN PF)	2	0	0	0	0	0	0	2
7	EMERGENCY EXIT	0	2	0	0	0	0	0	2
8	GND-CONC Staircase (for Min. 2 no. of Entry/Exit Gates)	0	0	0	2	0	0	0	2
9	GND-CONC Escalator (for Min. 2 no. of Entry/Exit Gates)	2	0	0	0	0	0	0	2
10	GND-CONC LIFTS (UP & DOWN side)	2	0	0	0	0	2	0	4
11	CONC Corridor (UP & DOWN Side)	2	0	0	0	0	0	0	2
12	Unpaid Area (AFC Entry Side) - TOM	1	0	0	0	0	0	0	1
13	Unpaid Area (AFC Entry Side)	0	2	0	0	0	0	1	3
14	Unpaid Area (AFC Exit Side)	0	2	0	0	0	0	1	3
15	AFC Entry gates	1	0	0	0	0	0	0	1
16	AFC Exit	1	0	0	0	0	0	0	1
17	Lifts & Mid Concourse	2	0	0	0	0	0	0	2
18	Concourse Area	4	0	0	0	0	0	0	4
19	Station Control Room	0	0	0	0	1	0	0	1
20	TER Gallery	0	0	0	0	1	0	0	1
21	Additional Concourse/ Platform/ Ground Area	0	0	0	0	1	0	0	1
Total Cameras per Elevated Station		35	6	2	2	7	4	2	58

Note: - * Lift Camera shall be provided by Lift Contractor (except the quantities specifically included in the BoQ).



2) Underground stations

S.No.	Location	FB Camera (Quad HD) (nos.)	Bullet Camera (Quad HD) (nos.)	FBIR Camera with Manual Focus & Zoom Control (4K UHD) (nos.)	FBIR Camera with Remote Focus & Zoom Control (4K UHD) (nos.)	FDIR Camera (Quad HD) (nos.)	Lift* Camera (Full HD) (nos.)	PTZ Camera (Quad HD) (nos.)	Total Cameras (nos.)
1	UP Platform (for 6 Coaches)	5	0	1	0	1	0	0	7
2	DOWN Platform (for 6 Coaches)	5	0	1	0	1	0	0	7
3	CONC-PF Staircase (UP)	2	0	0	0	0	0	0	2
4	CONC-PF Staircase (DOWN)	2	0	0	0	0	0	0	2
5	Lift (UP & DOWN PF)	0	0	0	0	2	2	0	4
6	ESP/PSB ((UP & DOWN PF)	2	0	0	0	0	0	0	2
7	EMEREGENCY EXIT	0	2	0	0	0	0	0	2
8	GND-CONC Staircase (for Min. 4 nos. of Entry/Exit Gates)	0	0	0	4	0	0	0	4
9	GND-CONC Escalator (for Min. 4 nos. of Entry/Exit Gates)	4	0	0	0	0	0	0	4
10	Entry/Exit Gates to CONC Corridor	6	0	0	0	0	0	0	6
11	GND-CONC LIFTS (Both side)	2	0	0	0	0	2	0	4
13	Unpaid Area (Both side) - TOM	2	0	0	0	0	0	0	2
14	Unpaid Area (Both Side)	0	4	0	0	0	0	2	6
16	AFC Entry gates	2	0	0	0	0	0	0	2
17	AFC Exit	2	0	0	0	0	0	0	2
18	Lifts & Mid Concourse	2	0	0	0	0	0	1	3
19	Concourse Area including EFO	5	0	0	0	0	0	0	5
20	Station Control Room	0	0	0	0	1	0	0	1
21	TER Gallery	0	0	0	0	1	0	0	1
22	DG Pump room	0	0	0	0	1	0	0	1
23	Fire Exit	0	0	0	0	2	0	0	2
Total Cameras per Underground Stn.		41	6	2	4	9	4	3	69

Note: - * Lift Camera shall be provided by Lift Contractor (except the quantities specifically included in the BoQ).



3) Depots

S.No.	Location	FB Camera (Quad HD) (nos.)	Bullet Camera (Quad HD) (nos.)	FBIR Camera with Manual Focus & Zoom Control (4K UHD) (nos.)	FBIR Camera with Remote Focus & Zoom Control (4K UHD) (nos.)	FDIR Camera (Quad HD) (nos.)	Lift* Camera (Full HD) (nos.)	PTZ Camera (Quad HD) (nos.)	Total Cameras (nos.)
1	Entry/Exit Gates & Security Time office (Min. 2 nos.)	0	0	2	0	0	0	2	4
2	DCC Building (Ground & 1st floor) along with with TER gallery	0	1	1	0	0	0	0	2
3	Admin building	1	0	0	0	0	0	0	1
4	IBL	3	0	0	0	0	0	0	3
5	SBL	3	0	0	0	0	0	0	3
6	ETU Building (Ground & 1st floor)	1	0	0	0	0	0	0	1
7	Canteen	0	1	0	0	0	0	0	1
8	DCOS (Unloading area)	0	0	1	0	0	0	0	1
9	Watch Towers (Min. 4 nos.) & Periphery of Depot	0	0	0	8	0	0	0	8
10	Test track	0	0	1	0	0	0	0	1
11	Outside IBL/SBL	0	0	0	0	0	0	1	1
12	Depot Ramp	0	0	1	0	0	0	1	2
Total Cameras per Depot		8	2	6	8	0	0	4	28

4) Miscellaneous Locations (Cameras / location)

S.No.	Location	FB Camera (Quad HD) (nos.)	Bullet Camera (Quad HD) (nos.)	FBIR Camera with Manual Focus & Zoom Control (4K UHD) (nos.)	FBIR Camera with Remote Focus & Zoom Control (4K UHD) (nos.)	FDIR Camera (Quad HD) (nos.)	Lift* Camera (Full HD) (nos.)	PTZ Camera (Quad HD) (nos.)	Total Cameras (nos.)
1	RSS			0	4	4			8
2	PSB								0
3	Ramp			0	2				2
4	Parking			0	2				2
5	FOB/Passage			3		1	1		5
6	Mid Shaft					4			4
7	Pt. Xing			1					1
8	River Bridge			0	4				4
9	Additional Platforms	6				2	1		9
10	OCC/BCC	10	5	10	5	30	3	6	69

Note: - * Lift Camera shall be provided by Lift Contractor (except the quantities specifically included in the BoQ).



5) Summary of Cameras per Location (Typical) and Total no. of Cameras for all locations (Phase-IV)

(Qty. in Nos.)

S.No.	Location	Total Cameras Per location	Total no. of each type of Cameras							Total Cameras	
			FB Camera (Quad HD)	Bullet Camera (Quad HD)	FBIR Camera with Manual Focus & Zoom Control (4K UHD)	FBIR Camera with Remote Focus & Zoom Control (4K UHD)	FDIR Camera (Quad HD)	Lift* Camera (Full HD)	PTZ Camera (Quad HD)		
1	Elevated Stations	58	27	945	162	54	54	189	108	54	1566
2	Underground Stations	69	18	738	108	36	72	162	72	54	1242
3	Depot	28	2	16	4	12	16	0	0	8	56
4	RSS	8	4	0	0	0	16	16	0	0	32
5	PSB	0	29	0	0	0	0	0	0	0	0
6	Ramp	2	5	0	0	0	10	0	0	0	10
7	Parking	2	5	0	0	0	10	0	0	0	10
8	FOB/Passage	5	8	0	0	24	0	8	8	0	40
9	Mid Shaft	4	0	0	0	0	0	0	0	0	0
10	Pt. Xing	1	86	0	0	86	0	0	0	0	86
11	River Bridge	4	1	0	0	0	4	0	0	0	4
12	Additional Platforms	9	2	12	0	0	0	4	2	0	18
13	OCC/BCC	69	1	10	5	10	5	30	3	6	69
			Total	1721	279	222	187	409	193	122	3133

* Lift Camera shall be provided by Lift Contractor (except the quantities specifically included in the BoQ).

Note: All special structures such as pillars or brackets etc. required to mount / erect cameras in or out side station, Depot TSSs/RSSs etc premises shall be the responsibility of Telecom Contractor only.

**Annexure-5****a) Specifications for Fixed Box and Bullet IP Colour Cameras (Quad HD & 4K UHD)**

S.No.	Parameter	Fixed Box IP Colour Camera		Bullet IP Colour Camera (Quad HD or better)
		Fixed Box (Quad HD or better)	Fixed Box (4K UHD or better)	
1	Image Sensor	1/2.8" or bigger, CMOS progressive scan image sensor, P-Iris sensor / Auto-Iris sensor	1/2" or bigger, CMOS progressive scan image sensor, P-Iris sensor / Auto-Iris sensor	1/2.9" or bigger, CMOS progressive scan image sensor, P-Iris sensor / Auto-Iris sensor
2	Pixel Resolution	Quad HD (2560*1440) or better (with 16:9 Aspect ratio)	8.0 Mega Pixel Ultra HD (3840x2160) or Higher (with 16:9 Aspect Ratio)	Quad HD (2560*1440) or better (with 16:9 Aspect ratio)
3	Data Rate	- with latest compression technology - Configurable between 64 Kbps (min.) to 6 Mbps(max) (Max. data rate of 6 Mbps per stream shall support Quad HD without any degradation)	- with latest compression technology - Configurable between 64 Kbps (min.) to 8 Mbps (max.) (Max. data rate of 8 Mbps per stream shall support 4K UHD without any degradation)	- with latest compression technology - Configurable between 64 Kbps (min.) to 6 Mbps(max) (Max. data rate of 6 Mbps per stream shall support Quad HD without any degradation)
4	Compression method	H.264 / H.265 or better	H.264 / H.265 or better	H.264 / H.265 or better
5	Video Streaming	Min. Three (3) video streams with H.264 / H.265 or better compression with: i) 25/30 FPS ii) Intelligent streaming iii) The streams shall be configurable as unicast or multicast, and all of them shall be configurable/ dynamically adaptable from SD to Quad HD iv) At any given time, following streams shall be available: a) 1st stream :- Quad HD b) 2nd stream :- Full HD c) 3rd stream :- SD	Min. Three (3) video streams with H.264 / H.265 or better compression with: i) 25/30 FPS ii) Intelligent streaming iii) The streams shall be configurable as unicast or multicast, and all of them shall be configurable/ dynamically adaptable from SD to 4K iv) At any given time, following streams shall be available: a) 1st stream :- Ultra HD (4k) b) 2nd stream :- Full HD c) 3rd stream :- SD	Min. Three (3) video streams with H.264 / H.265 or better compression with: i) 25/30 FPS ii) Intelligent streaming iii) The streams shall be configurable as unicast or multicast, and all of them shall be configurable/ dynamically adaptable from SD to Quad HD iv) At any given time, following streams shall be available: a) 1st stream :- Quad HD b) 2nd stream :- Full HD c) 3rd stream :- SD
6	Sensitivity @ 30 IRE F1.4 -F1.6 (if AGC is off) a) Colour Mode b) Monochrome mode	0.10 Lux 0.05 Lux	0.10 Lux 0.05 Lux	0.10 Lux 0.05 Lux
7	Shutter Speed	1 to 1/10000 sec or better	1 to 1/10000 sec or better	1 to 1/10000 sec or better
8	Wide Dynamic Range (WDR)	≥ 100 dB	≥ 100 dB	≥ 100 dB



S.No.	Parameter	Fixed Box IP Colour Camera		Bullet IP Colour Camera (Quad HD or better)
		Fixed Box (Quad HD or better)	Fixed Box (4K UHD or better)	
9	Angle of View (Horizontal & Vertical)	As specified in Specifications for Varifocal Lens detailed in clause 5.2.2	As specified in Specifications for Varifocal Lens detailed in clause 5.2.2	33° x 20° (wide)
10	IR Filter	Auto, Manual, Remote	Auto, Manual, Remote	Auto, Manual, Remote
11	Motorized Varifocal Lens	Separate Lens – Shall be compatible with the Fixed Box IP camera & comply to specifications given for Varifocal lenses.	Separate Lens – Shall be compatible with the Fixed Box IP camera & comply to specifications given for varifocal lenses.	4.5 mm - 10 mm, 1 m minimum object distance, IR corrected lens suitable for Bullet IP Colour Camera (Quad HD or better)
12	Infra-Red (If required with the Camera)	Infra-Red illuminator with range of 50 mtrs. or more shall be as per specifications for IR illuminator given in Para 5 of these specifications. IR illuminator shall be fully compatible with the Housing & the Camera	Infra-Red illuminator with range of 50 mtrs. or more shall be as per specifications for IR illuminator given in Para 5 of these specifications. IR illuminator shall be fully compatible with the Housing & the Camera	Built-in Infra-Red illuminator with range of 30 mtrs. or more.
13	Digital Zoom	NA	NA	NA
14	Focus & Iris control	Auto back Focus, As per details included in specifications for Vari-Focal Lens	Auto back Focus, As per details included in specifications for Vari-Focal Lens	Motorized Focus , Auto IRIS Control
15	Pan & Tilt Control	NA	NA	NA
16	Presets & Tours	NA	NA	NA
17	Intelligent Auto Tracking	NA	NA	NA
18	Sector blanking	NA	NA	NA
19	Heater & Blower	NA	NA	NA
20	Housing and mounting arrangement	As per specifications included in Para 5 of these specifications	As per specifications included in Para 5 of these specifications	Integrated Housing & Mounting arrangement suitable for PoE based IP cameras with IK10 protection rating



S.No.	Parameter	Fixed Box IP Colour Camera		Bullet IP Colour Camera (Quad HD or better)
		Fixed Box (Quad HD or better)	Fixed Box (4K UHD or better)	
21	Edge Analytics	Camera shall be equipped with following in-built /integrated edge video analytics as a min.: a) Intrusion detection b) Left Object detection c) Removed Object detection d) Over Crowding e) Camera Tampering f) Loitering	Camera shall be equipped with following in-built /integrated edge video analytics as a min.: a) Intrusion detection b) Left Object detection c) Removed Object detection d) Over Crowding e) Camera Tampering f) Loitering	Camera shall be equipped with following in-built /integrated edge video analytics as a min.: a) Intrusion detection b) Left Object detection c) Removed Object detection d) Over Crowding e) Camera Tampering f) Loitering
22	Protection Rating with Housing	IP66/NEMA-4x or better	IP66/NEMA-4x or better	IP66/NEMA-4x or better
23	Signal to Noise ratio	≥ 50 dB when AGC is Off	≥ 50 dB when AGC is Off	≥ 50 dB when AGC is Off
24	Day/Night Camera	Auto Day/Night configuration	Auto Day/Night configuration	Auto Day/Night configuration
25	Camera stamping (On/Off)	Logo, Name, Date & Time	Logo, Name, Date & Time	Logo, Name, Date & Time
26	Edge Storage	Edge storage with built in slot compatible for SD/SDHC/SDXC memory card of 128 GB or higher with Class 10 Speed. (Min. 128 GB memory card is to be supplied).	Edge storage with built in slot compatible for SD/SDHC/SDXC memory card of 128 GB or higher with Class 10 Speed. (Min. 128 GB memory card is to be supplied).	Edge storage with built in slot compatible for SD/SDHC/SDXC memory card of 128 GB or higher with Class 10 Speed. (Min. 128 GB memory card is to be supplied).
27	Network Interface	Ethernet (RJ45), 100BaseT auto sensing	Ethernet (RJ45), 100BaseT auto sensing	Ethernet (RJ45), 100BaseT auto sensing
28	Camera discovery in local Network	OEM application – For Automatic discovery / detection of all cameras in local network and to configure network setting.	OEM application – For Automatic discovery / detection of all cameras in local network and to configure network setting.	OEM application – For Automatic discovery / detection of all cameras in local network and to configure network setting.
29	Supported Protocols	TCP, UDP, HTTP, HTTPS, IGMP, IPv4, IPv6, SNMP, DNS, NTP, DHCP, ARP, ONVIF etc. or as required to fulfil the functional requirement of the project.	TCP, UDP, HTTP, HTTPS, IGMP, IPv4, IPv6, SNMP, DNS, NTP, DHCP, ARP, ONVIF etc. or as required to fulfil the functional requirement of the project.	TCP, UDP, HTTP, HTTPS, IGMP, IPv4, IPv6, SNMP, DNS, NTP, DHCP, ARP, ONVIF etc. or as required to fulfil the functional requirement of the project.
30	Web Server	Internal Web server required with embedded operating system.	Internal Web server required with embedded operating system.	Internal Web server required with embedded operating system.
31	Auto Gain Control	On/Off / Auto	On/Off / Auto	On/Off / Auto



S.No.	Parameter	Fixed Box IP Colour Camera		Bullet IP Colour Camera (Quad HD or better)
		Fixed Box (Quad HD or better)	Fixed Box (4K UHD or better)	
32	Back Light Compensation / Anti Blooming	On/Off	On/Off	On/Off
33	White Balance	Auto/Manual	Auto/Manual	Auto/Manual
34	Inputs/ Outputs (min.) (a) Alarms (b) Audio	<p>1 Input - Compatible with ESP-CCTV or Telephone - CCTV interface as defined in Chapter-3 – Interface (Roles & Responsibilities). Cameras shall have inbuilt provision to receive Input from Normal open/Normal Close potential free contacts.</p> <p>1 Output – Details to be submitted during design stage for approval of the Engineer.</p> <p>Line input - compatible for external Microphone. Details of the Input port to be provided.</p> <p>Line output - Details to be submitted during design stage for approval of the Engineer</p> <p>Streaming - Bidirectional Full duplex, Compression - G.711 or better Microphones - Either inbuilt Microphones shall be provided in the cameras or min. 2% cameras shall be provided with compatible external Microphones</p>	<p>1 Input - Compatible with ESP-CCTV or Telephone - CCTV interface as defined in Chapter-3 – Interface (Roles & Responsibilities). Cameras shall have inbuilt provision to receive Input from Normal open/Normal Close potential free contacts.</p> <p>1 Output – Details to be submitted during design stage for approval of the Engineer.</p> <p>Line input - compatible for external Microphone. Details of the Input port to be provided.</p> <p>Line output - Details to be submitted during design stage for approval of the Engineer</p> <p>Streaming - Bidirectional Full duplex, Compression - G.711 or better Microphones - Either inbuilt Microphones shall be provided in the cameras or min. 2% cameras shall be provided with compatible external Microphones</p>	<p>1 Input - Compatible with ESP-CCTV or Telephone - CCTV interface as defined in Chapter-3 – Interface (Roles & Responsibilities). Cameras shall have inbuilt provision to receive Input from Normal open/Normal Close potential free contacts.</p> <p>1 Output – Details to be submitted during design stage for approval of the Engineer.</p> <p>Line input - compatible for external Microphone. Details of the Input port to be provided.</p> <p>Line output - Details to be submitted during design stage for approval of the Engineer</p> <p>Streaming - Bidirectional Full duplex, Compression - G.711 or better Microphones - Either inbuilt Microphones shall be provided in the cameras or min. 2% cameras shall be provided with compatible external Microphones</p>
35	Dual power options	Ethernet, PoE / PoE+ (IEEE 802.3af/at compliant) and 24 V AC/ 12V DC/24V DC	Ethernet, PoE / PoE+ (IEEE 802.3af/at compliant) and 24 V AC/ 12V DC/24V DC	Ethernet, PoE / PoE+ (IEEE 802.3af/at compliant) and 24 V AC/ 12V DC/24V DC
36	Operating Temperature	0 °C to + 50 °C (min.)	0 °C to + 50 °C (min.)	0 °C to + 50 °C (min.)
37	Storage Temp	0 °C to + 60 °C (min.)	0°C to + 60 °C (min.)	0°C to + 60 °C (min.)
38	Humidity	Up-to 90% RH non-condensing	Up-to 90% RH non-condensing	Up-to 90% RH non-condensing
39	Time Synchronisation	Embedded Real Time clock, NTP client	Embedded Real Time clock, NTP client	Embedded Real Time clock, NTP client
40	Flicker control	50 Hz, 60 Hz	50 Hz, 60 Hz	50 Hz, 60 Hz



S.No.	Parameter	Fixed Box IP Colour Camera		Bullet IP Colour Camera (Quad HD or better)
		Fixed Box (Quad HD or better)	Fixed Box (4K UHD or better)	
41	MAC Address	The MAC address of the IP cameras must be registered in the name of OEM supplying the camera, but not in the name of OEM/Company/Entity of countries sharing the land border of India.	The MAC address of the IP cameras must be registered in the name of OEM supplying the camera, but not in the name of OEM/Company/Entity of countries sharing the land border of India.	The MAC address of the IP cameras must be registered in the name of OEM supplying the camera, but not in the name of OEM/Company/Entity of countries sharing the land border of India.
42	ONVIF (Open Network Video Interface forum) Compliance	The camera shall comply to ONVIF standards with Profile 'S', 'G' and 'T' The quoted models should appear on the ONVIF website and a confirmation certificate for the offered models should be available at the time of supply.	The camera shall comply to ONVIF standards with Profile 'S', 'G' and 'T' The quoted models should appear on the ONVIF website and a confirmation certificate for the offered models should be available at the time of supply.	The camera shall comply to ONVIF standards with Profile 'S', 'G' and 'T' The quoted models should appear on the ONVIF website and a confirmation certificate for the offered models should be available at the time of supply.
43	Firmware upgrade	It shall be possible to remotely upgrade the firmware of the camera.	It shall be possible to remotely upgrade the firmware of the camera.	It shall be possible to remotely upgrade the firmware of the camera.
44	GBT Standard	The Camera to be provided by the bidder should not be complying to GB28181, GB/T28181-2011 standards and there should be no option to activate or deactivate GB/T 28181 standards in the camera web page/Settings.	The Camera to be provided by the bidder should not be complying to GB28181, GB/T28181-2011 standards and there should be no option to activate or deactivate GB/T 28181 standards in the camera web page/Settings.	The Camera to be provided by the bidder should not be complying to GB28181, GB/T28181-2011 standards and there should be no option to activate or deactivate GB/T 28181 standards in the camera web page/Settings.
45	Regulatory Approvals/Certifications	<ol style="list-style-type: none"> 1) UL/EN certification for safety and FCC Certifications for EMC & Immunity. 2) The Regulatory Approvals/Certifications are to be provided from: <ol style="list-style-type: none"> a) NABL/NABCB accredited Labs or internationally reputed and accredited Labs/Agencies and b) STQC or any other Government Agency from the list of CERT-In empanelled Information Security Auditing Organization. 	<ol style="list-style-type: none"> 1) UL/EN certification for safety and FCC Certifications for EMC & Immunity. 2) The Regulatory Approvals/Certifications are to be provided from: <ol style="list-style-type: none"> a) NABL/NABCB accredited Labs or internationally reputed and accredited Labs/Agencies and b) STQC or any other Government Agency from the list of CERT-In empanelled Information Security Auditing Organization. 	<ol style="list-style-type: none"> 1) UL/EN certification for safety and FCC Certifications for EMC & Immunity. 2) The Regulatory Approvals/Certifications are to be provided from: <ol style="list-style-type: none"> a) NABL/NABCB accredited Labs or internationally reputed and accredited Labs/Agencies and b) STQC or any other Government Agency from the list of CERT-In empanelled Information Security Auditing Organization.



S.No.	Parameter	Fixed Box IP Colour Camera		Bullet IP Colour Camera (Quad HD or better)
		Fixed Box (Quad HD or better)	Fixed Box (4K UHD or better)	
46	Makes for Cameras	<p>Pelco, Axis, Avigilon, GE, IndigoVision, Panasonic, Bosch, Sony, Honeywell, Siemens, Dvtel, Tyco or equivalent subject to meeting the above specs.</p> <p>Printed data sheet of manufacturer shall be attached with the bid proposal, clearly identifying clause by clause compliance.</p>	<p>Pelco, Axis, Avigilon, GE, IndigoVision, Panasonic, Bosch, Sony, Honeywell, Siemens, Dvtel, Tyco or equivalent subject to meeting the above specs.</p> <p>Printed data sheet of manufacturer shall be attached with the bid proposal, clearly identifying clause by clause compliance.</p>	<p>Pelco, Axis, Avigilon, GE, IndigoVision, Panasonic, Bosch, Sony, Honeywell, Siemens, Dvtel, Tyco or equivalent subject to meeting the above specs.</p> <p>Printed data sheet of manufacturer shall be attached with the bid proposal, clearly identifying clause by clause compliance.</p>



b) Specifications for Fixed Dome, High Speed, PTZ Dome & Lift IP Colour Cameras (Quad HD)

S.No.	Parameter	Fixed Dome IP Colour Camera with IR illuminator (Quad HD or better)	High Speed, PTZ Dome IP Colour Camera (Quad HD or better)	Corner Lift IP Colour Camera (Full HD or better) (To be supplied by Lift Contractor)
1	Image Sensor	1/2.9" or bigger, CMOS sensor, Progressive scan	1/2.8" or bigger, CMOS progressive scan image sensor, P-Iris / Auto-Iris sensor	1/2.8" or bigger, CMOS progressive scan image sensor
2	Pixel Resolution	Quad HD (2560*1440) or better (with 16:9 Aspect Ratio)	Quad HD (2560*1440) or better (with 16:9 Aspect Ratio)	Full HD (1920 x 1080) or better (with 16:9 Aspect Ratio)
3	Data Rate	- with latest compression technology - Configurable between 64 Kbps (min.) to 6 Mbps (max.) (Max. data rate of 6 Mbps per stream shall support Quad HD without any degradation)	- with latest compression technology - Configurable between 64 Kbps (min.) to 6 Mbps (max.) (Max. data rate of 6 Mbps per stream shall support Quad HD without any degradation)	- with latest compression technology - Configurable between 64 Kbps (min.) to 4 Mbps (max.) (Max. data rate of 4 Mbps per stream shall support Full HD without any degradation)
4	Compression method	H.264 / H.265 or better	H.264 / H.265 or better	H.264 / H.265 or better
5	Video Streaming	Min. Three (3) video streams with H.264 / H.265 or better compression with: i) 25/30 FPS ii) Intelligent streaming iii) The streams shall be configurable as unicast or multicast, and all of them shall be configurable/ dynamically adaptable from SD to Quad HD iv) At any given time, following streams shall be available: a) 1st stream :- Quad HD b) 2nd stream :- Full HD c) 3rd stream :- SD	Min. Three (3) video streams with H.264 / H.265 or better compression with: i) 25/30 FPS ii) Intelligent streaming iii) The streams shall be configurable as unicast or multicast, and all of them shall be configurable/ dynamically adaptable from SD to Quad HD iv) At any given time, following streams shall be available: a) 1st stream :- Quad HD b) 2nd stream :- Full HD c) 3rd stream :- SD	Min. Three (3) video streams with H.264 / H.265 or better compression with: i) 25/30 FPS ii) Intelligent streaming iii) The streams shall be configurable as unicast or multicast, and all of them shall be configurable/ dynamically adaptable from SD to Full HD iv) At any given time, following streams shall be available: a) 1st stream :- Full HD b) 2nd stream :- Full HD c) 3rd stream :- SD
6	Sensitivity @ 30 IRE F1.4 - F1.6 (if AGC is off) a) Colour Mode b) Monochrome mode	0.3 Lux 0.05 Lux	0.3 Lux 0.05 Lux	0.3 Lux 0.05 Lux
7	Shutter Speed	1 to 1/10000 sec or better	1 to 1/10000 sec or better	1 to 1/8000 sec or better
8	Wide Dynamic Range (WDR)	≥100 dB	≥ 100 dB	≥ 65 dB



S.No.	Parameter	Fixed Dome IP Colour Camera with IR illuminator (Quad HD or better)	High Speed, PTZ Dome IP Colour Camera (Quad HD or better)	Corner Lift IP Colour Camera (Full HD or better) (To be supplied by Lift Contractor)
9	Angle of View (Horizontal & Vertical)	89°X 47° (min.)		115° X 77° (min.)
10	IR Filter	Auto, Remote	Auto, Remote	Auto, Remote
11	Motorized Varifocal Lens	Integrated Vari-focal lens 3.2 mm - 10 mm, F 1.4 - F 1.6, IR corrected, Day/Night, Motorised Auto Back-Focus, Auto DC Iris	(a) Optical zoom 20x or better IR corrected lens suitable for Quad HD PTZ Camera. (b) Focal length of lens: upper range shall be 88.4 mm or higher	Fixed 2.4 mm or better
12	Infra-Red (If required with the Camera)	Built-in Infra-Red illuminator, with range of 30 mtrs. or more,	Built-in Infra-Red illuminator, with range of 125 mtrs. or more.	Built in Infra-red illuminator with range 9 m or more
13	Digital Zoom	NA	12x or better	NA
14	Focus & Iris control	- Auto-back Focus, Auto DC-Iris	Automatic with manual override	NA
15	Pan & Tilt Control	Manual (Pan Adjustment - 360° , Tilt Adjustment-90°)	Pan/Tilt adjustment: 360° continuous pan, 0° to 90° tilt from horizontal plane Pan/Tilt Speed: 1°/sec to 90 °/sec	NA
16	Presets & Tours	NA	Presets: Maximum 256 programmable Presets with 16-character titles Preset Speed: 120°/sec ± 0.5° accuracy Tours: 2	NA
17	Intelligent Auto Tracking	NA	Camera automatically pans and tilts to follow the moving object until the object stops or disappears from the monitored area.	NA
18	Sector blanking	NA	360° Pan rotation to be divided in 24 individually configurable Privacy Masks/Zones as required by operator.	NA
19	Heater & Blower	NA	Arrangement shall be there with requisite power supply requirements	NA
20	Housing and mounting arrangement	Integrated with the Camera complying to all specifications as included in Para 5 of these specifications	Integrated with the Camera complying to all specifications as included in Para 5 of these specifications	a) Housing arrangement shall be in accordance with Lift Car b) Housing shall be elegant & compact in design with brushed steel or white finish.



S.No.	Parameter	Fixed Dome IP Colour Camera with IR illuminator (Quad HD or better)	High Speed, PTZ Dome IP Colour Camera (Quad HD or better)	Corner Lift IP Colour Camera (Full HD or better) (To be supplied by Lift Contractor)
				c) Housing & mounting arrangement shall be provided by Camera manufacturer.
21	Edge Analytics	Camera shall be equipped with following in-built /integrated edge video analytics as a min.: a) Intrusion detection b) Left Object detection c) Removed Object detection d) Over Crowding e) Camera Tampering f) Loitering	Camera shall be equipped with following in-built /integrated edge video analytics as a min.: a) Intrusion detection b) Camera Tampering	Camera shall be equipped with following in-built /integrated edge video analytics as a min.: a) Left Object detection b) Camera Tampering
22	Protection Rating with Housing	- IP66/NEMA-4x or better - IK10 or better	- IP66/NEMA-4x or better - IK10 or better	- IP65 - IK10 or better
23	Signal to Noise ratio	≥ 50 dB when AGC is Off	≥ 50 dB when AGC is Off	≥ 50 dB when AGC is Off
24	Day/Night Camera	Auto Day/Night configuration	Auto Day/Night configuration	Auto Day/Night configuration
25	Camera stamping (On/Off)	Logo, Name, Date & Time	Logo, Name, Date & Time	Logo, Name, Date & Time
26	Edge Storage	Edge storage with built in slot compatible for SD/SDHC/SDXC memory card of 128 GB or higher with Class 10 Speed. (min. 128 GB memory card is to be supplied).	Edge storage with built in slot compatible for SD/SDHC/SDXC memory card of 128 GB or higher with Class 10 Speed. (min. 128 GB memory card is to be supplied).	Edge storage with built in slot compatible for SD/SDHC/SDXC memory card of 128 GB or higher with Class 10 Speed. (min. 128 GB memory card is to be supplied)..
27	Network Interface	Ethernet (RJ45), 100BaseT auto sensing	Ethernet (RJ45), 100BaseT auto sensing	Ethernet (RJ45), 100BaseT auto sensing
28	Camera discovery in local Network	OEM application – For Automatic discovery / detection of all cameras in local network and to configure network setting.	OEM application – For Automatic discovery / detection of all cameras in local network and to configure network setting.	OEM application – For Automatic discovery / detection of all cameras in local network and to configure network setting.
29	Supported Protocols	TCP, UDP, HTTP, HTTPS, IGMP, IPv4, IPv6, SNMP, DNS, NTP, DHCP, ARP, ONVIF etc. or as required to fulfil the functional requirement of the project.	TCP, UDP, HTTP, HTTPS, IGMP, IPv4, IPv6, SNMP, DNS, NTP, DHCP, ARP, ONVIF etc. or as required to fulfil the functional requirement of the project.	TCP, UDP, HTTP, HTTPS, IGMP, IPv4, IPv6, SNMP, DNS, NTP, DHCP, ARP, ONVIF etc. or as required to fulfil the functional requirement of the project.
30	Web Server	Internal Web server required with embedded operating system.	Internal Web server required with embedded operating system.	Internal Web server required with embedded operating system.
31	Auto Gain Control	On/Off / Auto	On/Off / Auto	On/Off / Auto
32	Back Light Compensation / Anti Blooming	On/Off	On/Off	On/Off
33	White Balance	Auto/Manual	Auto/Manual	Auto/Manual



S.No.	Parameter	Fixed Dome IP Colour Camera with IR illuminator (Quad HD or better)	High Speed, PTZ Dome IP Colour Camera (Quad HD or better)	Corner Lift IP Colour Camera (Full HD or better) (To be supplied by Lift Contractor)
34	Inputs/ Outputs (min.) (a) Alarms (b) Audio	1 Input - Compatible with ESP-CCTV or Telephone - CCTV interface as defined in Chapter-3 – Interface (Roles & Responsibilities). Cameras shall have inbuilt provision to receive Input from Normal open/Normal Close potential free contacts. 1 Output – Details to be submitted during design stage for approval of the Engineer. Line input - compatible for external Microphone. Details of the Input port to be provided. Line output - Details to be submitted during design stage for approval of the Engineer Streaming - Bidirectional Full duplex, Compression - G.711 or better Microphones - Either inbuilt Microphones shall be provided in the cameras or min. 2% cameras shall be provided with compatible external Microphones	1 Input - Compatible with ESP-CCTV or Telephone - CCTV interface as defined in Chapter-3 – Interface (Roles & Responsibilities). Cameras shall have inbuilt provision to receive Input from Normal open/Normal Close potential free contacts. 1 Output – Details to be submitted during design stage for approval of the Engineer. Line input - compatible for external Microphone. Details of the Input port to be provided. Line output - Details to be submitted during design stage for approval of the Engineer Streaming - Bidirectional Full duplex, Compression - G.711 or better Microphones - Either inbuilt Microphones shall be provided in the cameras or min. 2% cameras shall be provided with compatible external Microphones	1 Input - Compatible with ESP-CCTV or Telephone - CCTV interface as defined in Chapter-3 – Interface (Roles & Responsibilities). Cameras shall have inbuilt provision to receive Input from Normal open/Normal Close potential free contacts. 1 Output – Details to be submitted during design stage for approval of the Engineer. Line input - compatible for external Microphone. Details of the Input port to be provided. Line output - Details to be submitted during design stage for approval of the Engineer Streaming - Bidirectional Full duplex, Compression - G.711 or better Microphones - Either inbuilt Microphones shall be provided in the cameras or min. 2% cameras shall be provided with compatible external Microphones
35	Dual power options	Ethernet PoE /PoE+(IEEE 802.3af/at compliant) and 24V AC/ 12VDC/24V DC	PoE/PoE+ IEEE 802.3af/at compliant) and 220VAC/24VAC /12VDC (Reliable option to be implemented)	PoE/PoE+ IEEE 802.3af/at compliant) and 220VAC/24VAC /12VDC (Reliable option to be implemented)
36	Operating Temperature	0 °C to + 50 °C (min.)	0 °C to + 50 °C (min.)	0 °C to + 50 °C (min.)
37	Storage Temp	0°C to + 60 °C (min.)	0°C to + 60 °C (min.)	0°C to + 60 °C (min.)
38	Humidity	Up-to 90% RH non-condensing	Up-to 90% RH non-condensing	Up-to 90% RH non-condensing
39	Time Synchronisation	Embedded Real Time clock, NTP client	Embedded Real Time clock, NTP client	Embedded Real Time clock, NTP client
40	Flicker control	50 Hz, 60 Hz	50 Hz, 60 Hz	50 Hz, 60 Hz
41	MAC Address	The MAC address of the IP cameras must be registered in the name of OEM supplying the camera, but not in the name of OEM/Company/Entity of countries sharing the land border of India.	The MAC address of the IP cameras must be registered in the name of OEM supplying the camera, but not in the name of OEM/Company/Entity of countries sharing the land border of India.	The MAC address of the IP cameras must be registered in the name of OEM supplying the camera, but not in the name of OEM/Company/Entity of countries sharing the land border of India.
42	ONVIF (Open Network Video Interface forum) Compliance	The camera shall comply to ONVIF standards with Profile 'S', 'G' and 'T'.	The camera shall comply to ONVIF standards with Profile 'S', 'G' and 'T'.	The camera shall comply to ONVIF standards with Profile 'S', 'G' and 'T'.



S.No.	Parameter	Fixed Dome IP Colour Camera with IR illuminator (Quad HD or better)	High Speed, PTZ Dome IP Colour Camera (Quad HD or better)	Corner Lift IP Colour Camera (Full HD or better) (To be supplied by Lift Contractor)
		The quoted models should appear on the ONVIF website and a confirmation certificate for the offered models should be available at the time of supply.	The quoted models should appear on the ONVIF website and a confirmation certificate for the offered models should be available at the time of supply.	The quoted models should appear on the ONVIF website and a confirmation certificate for the offered models should be available at the time of supply.
43	Firmware upgrade	It shall be possible to remotely upgrade the firmware of the camera.	It shall be possible to remotely upgrade the firmware of the camera.	It shall be possible to remotely upgrade the firmware of the camera.
44	GBT Standard	The Camera to be provided by the bidder should not be complying to GB28181, GB/T28181-2011 standards and there should be no option to activate or deactivate GB/T 28181 standards in the camera web page/Settings.	The Camera to be provided by the bidder should not be complying to GB28181, GB/T28181-2011 standards and there should be no option to activate or deactivate GB/T 28181 standards in the camera web page/Settings.	The Camera to be provided by the bidder should not be complying to GB28181, GB/T28181-2011 standards and there should be no option to activate or deactivate GB/T 28181 standards in the camera web page/Settings.
45	Regulatory Approvals/ Certifications	<ol style="list-style-type: none">1) UL/EN certification for safety and FCC Certifications for EMC & Immunity.2) The Regulatory Approvals/Certifications are to be provided from:<ol style="list-style-type: none">a) NABL/NABCB accredited Labs or internationally reputed and accredited Labs/Agencies andb) STQC or any other Government Agency from the list of CERT-In empanelled Information Security Auditing Organization.	<ol style="list-style-type: none">1) UL/EN certification for safety and FCC Certifications for EMC & Immunity.2) The Regulatory Approvals/Certifications are to be provided from:<ol style="list-style-type: none">a) NABL/NABCB accredited Labs or internationally reputed and accredited Labs/Agencies andb) STQC or any other Government Agency from the list of CERT-In empanelled Information Security Auditing Organization.	<ol style="list-style-type: none">1) UL/EN certification for safety and FCC Certifications for EMC & Immunity.2) The Regulatory approvals/ Certifications are to be provided from:<ol style="list-style-type: none">a) NABL/NABCB accredited Labs or internationally reputed and accredited Labs/Agencies andb) STQC or any other Government Agency from the list of CERT-In empanelled Information Security Auditing Organization.
46	Makes for Cameras	Pelco, Axis, Avigilon, GE, Indigovision, Panasonic, Bosch, Sony, Honeywell, Siemens, Dvtel, Tyco or equivalent subject to meeting the above specs. Printed data sheet of manufacturer shall be attached with the bid proposal, clearly identifying clause by clause compliance.	Pelco, Axis, Avigilon, GE, Indigovision, Panasonic, Bosch, Sony, Honeywell, Siemens, Dvtel, Tyco or equivalent subject to meeting the above specs. Printed data sheet of manufacturer shall be attached with the bid proposal, clearly identifying clause by clause compliance.	Pelco, Axis, Avigilon, GE, Indigovision, Panasonic, Bosch, Sony, Honeywell, Siemens, Dvtel, Tyco or equivalent subject to meeting the above specs. Printed data sheet of manufacturer shall be attached with the bid proposal, clearly identifying clause by clause compliance.



Annexure 6

REQUIREMENTS OF FULL HD LASER VIDEO WALL (SIZE: 5X2 X70")

1) FUNCTIONAL REQUIREMENTS

- i) A Full HD laser video wall (size: 5x2 x70") shall be provided at two locations (IT park and BCC-Vinod Nagar Depot) for monitoring all Cameras of Phase-IV CCTV System. These location(s) may be amended during execution as per availability of space for centralized security room.
- ii) Full HD laser Video wall Should have the scalability and upgradeability to be made up of multiple rear projection modules (size) stacked up in rows and columns, to achieve a display wall behaving as a single logical screen, for better viewing ability in linear or curved configuration.

The display wall should be rugged and industrial nature and should be able to work in 24*7 environments

- iii) Full HD laser video wall in the security control room shall be used for displaying live views of IP CCTV cameras, graphics from the PC, Workstation, etc. It should have the functionality to pre-configure and save various display layouts to be accessed at any given point of time with a simple mouse click. The Video Wall arrangement including all equipments, accessories, cables, mounting structure/frame, Decoding Units, Controllers, Wall management Software, etc shall be provided and implemented by the CCTV (DS16) Contractor.
- iv) The large screen should be able to show the images of the monitor, which is connected on the LAN with Windows 10 pro or the latest OS and the windows should be freely resizable, re-scalable and repositionable on any part of the large video screen.
- v) It shall be possible for the user to define different display layout with different nos. of views and different sizes and save them, so as to be used as and when required. Maximum nos. of simultaneous views possible in a display layout shall be 120.
- vi) In any displayed layout of video wall, live view of any of Phase-IV camera and graphics from the associated PC/Workstation shall be viewed on any of display windows. Also view of single camera shall be displayed on multiple display windows of a display layout.
- vii) There shall be provision to display more than one different size display layout simultaneously on same video wall.
- viii) Live views of IP Cameras of line 7 & 8 Ext. shall also be viewed on existing video wall at IT Park and BCC- Vinod Nagar Depot. For this provision, FOTS (DS11) Contractor shall provide all required networking resources (Routers and multicast address capacity of phase-III CCTV System) at OCC-Metro Bhawan for integrating associated rings of line 7 & Line 8 ext. with Phase-III CCTV network. Network Address Translation (NAT) protocol shall be used to convert an IP address in one network to a different IP address in another network. Accordingly, CCTV Contractor shall interface with FOTS (DS11) Contractor to provide all relevant details i.e. IP addresses of Cameras of Line 7 & 8 Ext and Group of unused IPs to be translated as per Phase-III CCTV Network.

CCTV Contractor shall be responsible for successful integration and commissioning of existing video wall and workstations with cameras of line 7 & 8 Ext. Any software and license required in this integration shall also be provided by CCTV (DS16) Contractor.

2) TECHNICAL SPECIFICATIONS

i) Laser Video wall:

The Laser video wall shall constitute of Rear projection modules, Mounting Stand,



Redundant Display Controller, Decoding Units and Wall Management Softwares. All these components shall be supplied from a single manufacturer with the following min. specifications:

Table 2.14: Laser Video Specifications

S.No.	Parameter	Specifications (min.)
1	Display Module	Single chip DLP based Rear Projection Module (Minimum Diagonal Size: 70")
2	Light source	RGB Laser, preferably without colour wheel. In event of proposing a solution with colour wheel, the contractor shall submit detailed explanation for the same along with its advantages to the Engineer for review & approval. Decision of the Engineer shall be final.
3	Laser lamp life	100,000 hrs. (Normal mode)
4	Resolution of Module	Full HD (1920x1080)
5	Aspect ratio of module	16:9
6	Design configuration of video wall	Total 10 cubes in 5x2 (column x row) configuration
7	Screen to screen gap	Adjustable up to 0.2 mm
8	Brightness uniformity	Up to 95%
9	Brightness (typical)	500 cd/m ²
10	Contrast Ratio (typical)	1800:1
11	AC input Voltage	100 – 240 VAC, 50-60Hz
12	Power consumption per module	350 Watt (max.)
13	Power Redundancy	Redundant laser bank with redundant power supply
14	Color Depth	16.7 million
15	Screen Viewing Angle (1/2 Gain)	H: 36° & V: 34°
16	Network	Dual 100/1000 Base-T Fail over Ethernet interface
17	Video inputs per Module	2 x DP1.2 / HDMI Input – with compatible converter
18	Video outputs per Module	1 x DP1.2 Output or 1 x HDMI Output
19	Signal Processing	Loop through scaling with wall configuration
20	Diagnostics	Built in web server
21	Operating Temperature	0°C-40°C
22	Humidity	Up-to 90%, non-condensing
23	Makes/Approvals	One of the reputed makes such as BARCO, DELTA, SAMSUNG, LG or equivalent subject to meeting the above specifications.

ii) Display Controller:

The Display Controller including I/O Modules and decoding units shall be redundant with auto switchover facility to ensure that no single failure of any controller, decoding unit or I/O module shall result in failure/blinking of a zone on the display wall. The Display controller should have the following min. specifications:

Table 2.15: Laser Video Specifications

S.No.	Parameter	Specifications (min.)
1	Display Controller	Industrial 19" rack mounted Servers with Redundant Configuration
2	Processor	Intel Xeon Processor 3.0 Ghz or better, Hyper threading, 20 MB cache or better.



S.No.	Parameter	Specifications (min.)
3	No. of Cores	8 Cores or higher
4	No. of Threads	16 Threads or higher
5	Memory	64GB or higher DDR4 SDRAM or latest
6	Hard Drives	2 x 512GB or higher SSD
7	RAID Controller	RAID Controller with RAID 0/1 Configuration
8	USB ports	4 USB 2.0
9	Optical Storage	DVD ROM Drive required
10	Network	4x1GbE with Load Balancing and Fail over Support.
11	Power supply	Dual redundant hot swappable power supplies.
12	OS	Latest Windows Server/Linux/Sun Solaris or as required for video wall CCTV operation.
13	Video Inputs	1 x Digital DVI-D 2 x HDMI 1 X Analog S-video
14	Video outputs	DVI/HDMI
15	Supported video Streams	SD,HD, Full HD, Quad HD & 4K
16	Supported Compression	MPEG, H.264 and H.265 or better
17	Makes & Approvals	One of the reputed makes such as IBM, Dell, HP, Fujitsu, Sun Microsystems or equivalent subject to meeting the above specifications. CE/FCC/UL / BIS Certification required.

- a) It should give multiple DVI graphics outputs to be connected to the multiple rear projection modules.
- b) The controller shall interface with hardware accelerated streaming video decoding using streaming video decoding unit.
- c) There should be possibility of connecting minimum 120 Streaming Video Inputs from different IP based Surveillance Cameras installed at stations to this controller to show the multiple Streams sources in scalable and moveable windows on the graphics wall.
- d) The decoder unit shall have a dual 100/1000 Base-T failover Ethernet interface. The decoder unit shall support IP, and TCP video stream formats. Each Decoding unit shall decode up to a maximum of 24 / 48 Streams.
- e) The decoder unit shall support Non-proprietary MPEG-1, MPEG-2, MPEG-4, MJPEG, H.264, H.265 and latest compression protocols.

iii) Video Wall Management Software:

- a) The Video wall Management Software should have the following specifications:
- c) The software should be able to preconfigure various display layouts and access them at any time with a simple mouse click or based on the timer.
- d) The software should enable the users to change the size and position of the various windows being shown on the Display Wall.
- e) The software should enable various operators to access the display wall from the local keyboard and mouse of their workstation connected with the Display Controller on the Ethernet.
- f) The software should enable users to display the screen content of Windows based workstations connected on the Ethernet in scalable and moveable windows in real time environment.



- g) The wall management software shall allow switching the video inputs.
- h) The software should support open API for third party integration
- i) The Diagnostic software shall perform health monitoring of the wall, the controller and the decoding units that allows timely detection of faults.
 - Wall health
 - Cube health
 - Cube IP-address
 - Brightness adjustments
 - Comprehensive colour adjustments
 - Wall Controller Health including automatic fail-over status
 - Decoding Unit Health including automatic fail-over status
- j) Diagnostic Software shall allow commands on wall level or cube level or a selection of cubes:
 - Switching the entire display wall on or off.
 - Setting all projection modules to a common brightness target.
 - Fine tune color of each cube
- k) Video Wall Management Software shall be interfaced (API-based interface) with CCTV Video management Software in such a way that following CCTV operations shall be performed easily through CCTV Video management Client application of associated workstation:
 - Selection of any Video Wall configuration i.e. 5x2, 3x2, 2x2 etc. integrated with CCTV Client application.
 - Selection of any display layout from the list of pre-configured display layouts through CCTV Client application
 - Selection of any Camera from the Camera list appearing in CCTV Client application through Mouse
 - Selection of any Camera from the Camera list appearing in CCTV Client application through Joystick by giving required input parameters i.e. Logical Monitor Number of display layout and Camera Number.

3) The bidder/Sub-contractor should fulfill the following requirements:

- i) The complete solution i.e. the projection modules, display controller, video streaming decoding units and the wall management software should be compatible and proven.
- ii) The Video display system vendor should have manufacturing facilities in India for video wall. The video wall modules and controllers should be from the same manufacturer and the display OEM shall have its own service center in India.
- iii) Should have the experience of executing at least 2 such similar size of contract of the display wall in past two years in India or abroad to the same specifications as in this tender. Proof by way of documentary support to be submitted in this regard from the User as part of the Bid Submission.

**APPENDIX-N****SPECIFICATIONS FOR WORKSTATION (MMI) & LAP TOP (LOCAL CRAFT TERMINAL)****1) SPECIFICATIONS FOR WORKSTATION (MMI)**

S. No	Parameters	Minimum Specification
1.	Processor	11th generation Intel Xeon-W / Core-i7 or better Processor, 8Core, 16Threads, 16MB Cache, Base speed 3.5GHz, up to 5.0GHz Turbo boost.
2.	RAM	1) Minimum installed RAM: a) For CCTV System (DS-16) 32GBx2, DDR4, 3200MHz, Dual Channel RAM with Error Correcting Capability (ECC). b) For Other Systems: 16GBx2, DDR4, 3200MHz, Dual Channel RAM. 2) Upgradable to 128 GB RAM. 3) At least 2 usable empty DIMM slots.
3.	Graphics Card (Dedicated)	a) For CCTV System (DS16) Dual 4 GB GDDR5, NVIDIA Quadro P1000 or equivalent b) For Other systems: Single 4 GB GDDR5, NVIDIA Quadro P1000 or equivalent
4.	LAN	1Gbps Ports – 2 nos.
5.	Storage	1) ≥ 1 no. x 2TB M/2 PCIe NVMe Solid State Drives in RAID-1 2) 2TB SSD / SATA 7200 rpm Hard Drive
6.	Display	1) Common features: a) Viewing angle (H/V): 170 degree or better b) Connectivity: i) 1 x Display Port / DVI (in) ii) 1 x Display Port / HDMI (out) iii) 1 x HDMI (in) iv) 1 x Analog 2.0 audio line out (3.5mm jack). v) 1 x VGA (in) (Optional) c) Integrated Soundbar (Min. 3.5Watts) d) Response Time: 5 ms or better e) Image Brightness (typical): 350 cd/m ² or better f) Display Position Adjustments: Tilt, Swivel, Pivot, Height Adjustments etc. g) VESA Flat Panel Mount Interface. h) Operating Temperature: 0°C to + 50°C i) Humidity: Up to 80% RH (non-condensing) 2) For CCTV System (DS-16) a) Viewable Size: 24" and 32" as per requirement (when measured diagonally) b) Resolution: 4K UHD (3840 x 2160) or better c) Image Contrast Ratio: (Typical) 3000:1 or better d) Colour Support: 1.07 billion or better 3) For Other systems:



S. No	Parameters	Minimum Specification
		a) Viewable Size: 24" or better when measured diagonally. b) Resolution: Full HD (1920 x 1200/1080) or better c) Panel Type: IPS or better d) Colour Support: 16.7 Million Colours or better
7.	Keyboard & Mouse	Wired / Wireless Keyboard & Mouse
8.	Additional Ports	USB 3.x Gen. Ports - 4 nos. HDMI Port on Chipset - 1 no. VGA Port – 1 no. (with Adapter, if required)
9.	Operating System	Preloaded Genuine Windows 10 (64bit) professional or as required
10.	OS Recovery Media	Recovery DVD/media for Operating system
11.	Pre-Loaded Software	Anti-Virus, MS Office 2019 or latest, Adobe PDF
12.	DVD	Dual Layer DVD-RW
13.	Approvals	The Workstation shall be UL/EN approved for safety and CE/FCC approved for EMC & immunity and shall be from reputed makes. The Contractor shall submit a proposal indicating the make & model of the proposed Workstation to the Engineer for review & approval. The workstation shall be procured only after receipt of no objection from the Engineer.

2) SPECIFICATIONS FOR KVM EXTENDER:

S. No	Parameters	Minimum Specification
1.	Remote connection	Dual Port Redundant Connectivity (i) for distance less than 150m: Ethernet connectivity with port activity indicator (ii) for distance more than 150m: Fiber connectivity with port activity indicator
2.	Network protocol	TCP/IP, LDAP, SNMP or as required.
3.	Display Resolution & Setup:	For CCTV System (DS16): (i) 4K UHD @ 50/60 Hz or better (ii) Single Monitor Setup: 1 x KVM (Single Monitor) (iii) Dual Monitor Setup: 1 x KVM (Dual Monitor) or 1 x KVM (Single Monitor) + 1 x KVM (Single Monitor) /HDMI or Display Port Extender (Compliant to all Parameters indicated in the Specs) For Other systems: (i) Full HD @ 50/60 Hz or better (ii) Single Monitor Setup: 1 x KVM (Single Monitor)



S. No	Parameters	Minimum Specification
4.	Indicator	Device status LED indicator with network activity
5.	Operating temperature	0 to 60°C
6.	Humidity	Up to 80% non-condensing
7.	Approvals	The Contractor shall submit a proposal indicating the make & model of the proposed KVM Extender to the Engineer for review & approval. The KVM Extender shall be procured only after receipt of no objection from the Engineer.

3) SPECIFICATIONS FOR LAP TOP (LOCAL CRAFT TERMINAL)

Sr.No	Parameters	Minimum Specification
1.	Processor	11th generation Intel Core-i7 or better Processor (8 MB Cache)
2.	RAM	16GB, DDR4, 3200MHz
3.	Storage	512GB 1 TB M.2 PCIe NVMe Solid State Drive + 1TB 7200 rpm 2.5" SATA Hard Drive
4.	Display	15.4 -inch FHD (1920 x 1080)
5.	Port	RJ45 Ports - 10/100/1000Mbps GbE - 1 no. USB 3.x Gen. Ports - 3 nos. HDMI Port - 1 no. VGA ports – 1 no. or with USB convertor
6.	Graphics Memory	2GB dedicated NVIDIA/AMD graphics card
7.	Operating System	Preloaded Genuine Windows 10 (64bit) professional
8.	Pre-Loaded Software	Anti-Virus, MS Office 2019 or latest, Adobe PDF
9.	OS Recovery Media	Recovery DVD/media for Operating system
10.	Approvals	Laptop shall be from reputed makes. The Contractor shall submit a proposal indicating the make & model of the proposed Laptop to the Engineer for review & approval. The Laptop shall be procured only after receipt of no objection from the Engineer.
Note: Laptop shall be used as Local Crafts Terminal (LCT) and shall therefore be compatible and loaded with system maintenance software. The laptop shall be supplied with all accessories i.e. Charger, Laptop Bag etc.		



Appendix-Q

SPECIFICATIONS OF RACK and OPTICAL DISTRIBUTION FRAME (ODF)

1. SPECIFICATION OF RACK

1.1 FLOOR MOUNTED RACK - 42U, 19" (800W X 2000H X 1000D):

Proposed rack shall have to maintain uniform design for all telecom subsystems (DS-11 to DS-16). The contractor shall obtain Engineer's approval for the design and specifications of the Rack including its Frame structure. The specification shall include but not limited to-

- i) Side panel (1.2 - 1.5 mm) with suitable sealing system. Front & Rear Doors (1.2 - 1.5 mm as applicable) shall be provided with PU Gasket. Composition of PU Gasket shall be submitted to Engineer for approval.

This Clause should be read in conjunction with Clause 10.11 of Chapter-1 - General Requirements.

- ii) Full Height 19" mounting angles
- iii) Top and bottom cover
- iv) Socket strips (5/15 amps, 10 points 2 strips with locking Arrangement to avoid loose Contact)
- v) Fan trays with 4 Fans with finger guard
- vi) Earthing kit
- vii) Vertical cable managers on both sides
- viii) Horizontal cable managers (5 Nos.)
- ix) Make- Rittal, **Panduit**, **Conteg**, APW President or equivalent subject to meeting the above specifications

1.2 WALL MOUNT RACK- 19" (9U, 6U & 3U)

- i) Rack shall be of Wall mount type with the help of fasteners.
- ii) Rack shall have Side panel, (1.2 - 1.5 mm) with suitable sealing system. (if applicable)
- iii) Rack shall have full height 19" mounting angles.
- iv) Junction Box in place of 3U rack may be installed to house 4-port Layer-2 field switch and mini-ODF (12 port) with accessories after its design approval from Engineer.
- v) Rack shall have following as a minimum:
 - a) Top, Bottom & **Rear** cover.
 - b) Cable Entry round holes (min. 34mm dia. and 4 nos.) with Glands at the bottom.
 - c) Earthing kit
 - d) Horizontal cable managers.
 - e) Capacity to Install 2 FMS (24/12 Fiber splicing in each FMS/ODF).
 - f) Front Opening on side hinges.



- g) Rack shall have glass at Front with lock and key.
- h) Make : Rittal, **Panduit, Conteg**, APW President ~~RPG Raychem, 3M etc.~~ or equivalent subject to meeting the above specifications.

2. Fibre Management System (FMS)

2.1 Optical Distribution Frame (ODF) - 48 /96/144 Fibre FMS

- a) Fibre Management/ODF System shall have following provisions as a minimum:

S.No.	Details	Requirement
1	Method of Mounting	Front mounting for 19" rack
2	Type of Adaptors	LC with insertion Loss of Adaptors < 0.1 db
3	Cable entry	Back side
4	Pigtails	Insertion Loss < 0.1 db
5	Anti Rodent Entry	The rear cable entry shall have the cover plate to restrict the rodent entry
6	Loose tube Protection	Spiral tube is to be provided for the protection and easy routing of the loose tube in the loose tube storage space.
7	Fibre routing chart	Fibre routing chart with color code indication shall be provided.
8	Capacity of Shelf	Upto 96/192/288 fibre capacity
9	Bend controls in splicing trays	The splicing tray is to be so designed that it guides and protects the pigtail and ensure controlled cable bending
10	Modular Construction	Flexible upgrade and expansion ready, customized application.
11	Grommets at cable entry	To reduce dust entry or physical damage to the cable
12	Make	RPG Raychem, 3M etc. or equivalent subject to meeting the specifications

- b) Min. capacity of the ODF shall be as specified below :

S. No.	Items	Minimum Quantity	Remarks
1	No. of splices	48 Fiber 48x2=96 nos. 96 Fiber 96x2=192 nos. 144 Fiber 144x2=288 nos.	Termination of one 48/96/144 fibres Cable from both directions
2	Maximum No. of splices per tray	12/24	Or in Multiples of no. of fibres in each tube of the Fibre cable
4	Front Access	Yes	To Provide easy front access to rear compartment & Jumpers.
5	Pass through Splicing Provision	Yes	Fibre to be splice will enter the Splicing shelf and will be spliced on the tray

2.2 FMS/Optical Distribution Frame (ODF) - 12 /24 Fibre

- i) 19" Rack mountable with rear side cable entry.



- ii) Material used: Cold Rolled Carbon (CRC) steel with thickness of minimum 1.2mm.
- iii) Cabinet Painting: Durable textured polyester powder coating.
- iv) Fixing and Earthing: Earth grounding point/stud at the side of the cabinet
- v) Suitable to common optical fiber cable, also to band optical fiber cable's fusion.
- vi) Core Capacity: 12, 24 fiber capacity
- vii) Pigtails: Insertion Loss < 0.1dB, color coded.
- viii) Standard working wavelength: 850nm, 1310nm, 1550nm
- ix) Spiral tube is to be provided for the protection and easy routing of the loose tube in the loose tube storage space.
- x) Adapter Type: LC with insertion Loss of Adaptors < 0.1 dB
- xi) Shall have provision for cable termination, splicing distribution and cross connection
- xii) Shall be composed of two ports, one is to be linked with optical fiber cable for fusion connections between optical cable and optical pigtails and the other part is to be linked with patch cords.
- xiii) Reliable protection appliance of fixing, striping and earthing for optical fiber cables. Anti-rodent cable entry. Grommets at cable entry for protection against dust and physical cable protection from sharp edges.

3. Digital Distribution Frame (DDF) - 2 Mbps (120 Ohm) interface

Min. specifications of DDF are as detailed below:

S.No.	Details	Requirements
1	Bay type	Single Bay
2	Type of Module	PCB type with wrapping type of termination
3	Isolation facility	The DDF shall have the facility for isolating the cable side and the equipment side by 4 Pin Plug/Socket arrangement
4	On line testing facility	On line testing facility shall be provided
5	Modular Capacity	120 Ohm module for catering 8 sets of trans and receive termination of 2 Mbps.
6	Termination type	Wire wrapping terminations for transmit and receive signals including provision to terminate earth limb of designated cables.
7	Earth of Bay	Earth terminal is to be provided on either side of the module
8	Impedance	120 Ohm balanced.
9	Insulation	Typical > 500 M Ohm between any two signal pins and ground.

- 4. All covers, panels & openings in the Racks, FMS, ODF & DDF etc. shall be suitably sealed with PU Gasket.
- 5. All Racks, FMS, ODF & DDF etc. shall conform to UL2416 and UL60950-1 or equivalent standard. **OEM should be ISO 9001, ISO 14001, ISO 45001 certified.** The contractor shall submit details of equivalent standard and its compliance to the Engineer for review and approval"



Sub-Clause (GC)	Description (Specific Provisions)
<p>Sub-Clause 13.8 Adjustments for Changes in Cost</p>	<p>GC Sub-Clause 13.8 is replaced with the following:</p> <p>Following provisions shall be applicable for the contracts having completion period of more than one year: -</p> <p>(i) Adjustment in contract price on account of inflation shall be as under:</p> <p>The rates as per the accepted Bill of Quantities shall be applicable till the completion of the Work and will be varied only to the extent of permissible price variation under this Clause. However, this adjustment shall be to the extent that , full compensation, for any rise or fall in costs, to the Contractor, if not covered by the Price variation formula, shall be deemed to be included in the rates of the accepted BoQ.</p> <p>The price variation shall be payable both on the Indian currency component and the Foreign currency component of the Contract Price.</p> <p>Payment as per the contract shall be subject to adjustment in accordance with the following Price Variation formula, and other terms given herein, to provide for variation in the market rates of inputs like labour, materials and fuel / power during the currency of the Contract:</p> $V = VI + Vf + Vm$ <p>Where,</p> <p>V = Total adjustment on account of all factors</p> <p>VI = Adjustment on account of labour component = $p \times R \times (I - I_0) / I_0$</p> <p>Vf = Adjustment on account of Fuel & Power component = $q \times R \times (Wf - Wfo) / Wfo$</p> <p>Vm = Adjustment on account of Material = $r \times R \times (Wm - Wmo) / Wmo$</p> <p>p = Cost Coefficient of Labour to the Total Cost = 0.30</p> <p><u>q</u> = Cost Coefficient of Fuel and Power to the Total Cost = 0.15</p> <p>r = Cost Coefficient of other Material to the Total Cost = 0.25</p> <p>Note : $p + q + r = 0.70$ shall be Variable Component and balance 0.30 shall be fixed component.</p> <p>R = Gross value of the work done, in respective currencies by the Contractor for the period of work under consideration, after excluding there from the cost of any materials supplied free or at fixed rate to the Contractor.</p>